HYDRAULIC ENGINEERING
ROUTING SLIP AND READING ROOM

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 23
DECEMBER 1, 1969

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Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is $22.00 (domestic), $27.50 (foreign), single copy price is $3.00. Certain documents abstracted in this journal can be purchased from the Clearinghouse at the prices indicated in the entry. Prepayment is required.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 2, NUMBER 23
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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

HYDROCALCITE AND NESQUEHONITE IN CARBONATE SCALES,
Heidelberg Univ. (West Germany). Sediment Lab.
For primary bibliographic entry see Field 02K.
W69-09449

ON THE INTERACTION OF WATER MOLECULES AND MONTMORILLONITE SURFACES,
Adelaide Univ. (Australia). Dept. of Agricultural Biochemistry and Soil Science.
For primary bibliographic entry see Field 02G.
W69-09481

ADSORPTION OF WATER ON SILICA,
Corning Glass Works, N.Y.
W. Hertl, and M. L. Hair.
Nature, Vol 223, No 5211, p 1150-1151, Sept 13, 1969. 2 p, 2 fig, 5 ref.

Descriptors: *Water structure, *Water chemistry, *Silica, *Adsorption, *Thermodynamics, Viscosity, Condensation, Interfaces, Hydrogen bonding.
Identifiers: *Water polymers, Adsorption isotherms.

Water was condensed on a silica surface from which all freely vibrating hydroxyl groups were removed, to study a possible structure of anomalous water or water polymer. In 9 runs in which water vapor was progressively admitted to the system, 2 distinct knees appeared on the adsorption isotherm, corresponding to adsorption of 1 and 3 molecules adsorbed on H-bonded surface hydroxyl groups. A third knee at 17 torr corresponds to adsorption of a third water layer on the silica surface. The number of layers at saturation is estimated to be 6. A flat hexagonal structure composed of 6 water molecules in 3 layers is proposed. If the structure were released from the surface it could produce a polymeric species with the high viscosity associated with the anomalous water reported elsewhere, although the models of structure differ in that the previously reported hexameric structure is octahedral rather than hexagonal-planar. (Knapp-USGS)
W69-09652

ANOMALIES IN THE THERMAL PROPERTIES OF WATER,
Florence Univ. (Italy). Dept. of Physical Chemistry.
R. Cini, G. Loglio, and A. Ficalbi.
Nature, Vol 223, No 5211, p 1148-1149, Sept 13, 1969. 2 p, 3 fig, 24 ref.

Descriptors: *Water structure, *Water properties, *Magnetic studies, *Surface tension, *Interfaces, Physical properties, Thermodynamic behavior, Boundary processes.
Identifiers: Interfacial tension, Magnetic susceptibility, Surface chemistry.

Magnetic susceptibility and interfacial tension of water-hexane and water-decane systems were studied to determine whether thermal irregularities in the magnetic susceptibility of water are due to bulk of interfacial effects. Experimental data are shown graphically. In all runs irregularities always appeared at the same temperatures, within 0.5 deg C, in both interfacial tension and in magnetic susceptibility. The interfacial origin of the anomalies is also shown by magnetic data of samples of water-silica gel systems. The irregularities are probably caused, in all systems studied, by ordered water structure at the phase interfaces. (Knapp-USGS)
W69-09653

INFERENCE OF STRATOSPHERIC TEMPERATURE AND MOISTURE PROFILES FROM OBSERVATIONS OF THE INFRARED HORIZON,
GCA Corp., Bedford, Mass.
For primary bibliographic entry see Field 02B.
W69-09659

POLYWATER,
Maryland Univ., College Park. Center for Materials Research; and National Bureau of Standards, Washington, D.C.
E. R. Lippincott, R. R. Stromberg, W. H. Grant, and G. L. Cessac.
Science, Vol 164, No 3887, p 1482-1487, June 1969. 6 p, 5 fig, 1 tab, 19 ref.

Descriptors: *Water structure, *Water chemistry, *Surfaces, *Hydrogen bonding, Molecular structure, Water properties, Absorption, Infrared radiation, Thermodynamics, Thermal properties.
Identifiers: *Anomalous water, *Polywater, Water polymers, Raman spectra, Infrared absorption spectra.

Recent reports of anomalous water or polywater by Russian and U.S. workers are reviewed and results of a study by the U.S. Bureau of Standards and the University of Maryland are discussed. The infrared and Raman spectra of a form of water prepared in fused quartz capillaries and previously designated as 'anomalous' water have been obtained. The infrared spectra appear to be unique, with the apparent absence of the O--H-stretching bands prominent in normal water spectra, and the appearance of new bands near 1600 and 1400 cm. The interpretation is that new and previously unreported strong symmetric O-H-O bonds are formed. These bonds are regarded as responsible for the remarkable properties of the material and have considerable covalent character. They are so strong that they cannot be considered as normal hydrogen bonds. The bond energy per O-H-O unit is given as approximately 125 to 210 kjoule/mole (30 to 50 kcal/mole), and an energy of 250 to 420 kjoules (60 to 100 kcal) per structural unit. Several structures are proposed which are consistent with the spectral data and the remarkable properties and stability of the material. It is concluded that the material is a true polymer of water and, therefore, is named polywater. (Knapp-USGS)
W69-09664

1B. Aqueous Solutions and Suspensions

STEADY GRAVITATIONAL CONVECTION INDUCED BY A LINE SOURCE OF SALT IN A SOIL,
Agricultural Research Service, Madison, Wis.
For primary bibliographic entry see Field 02G.
W69-09475

CHEMICAL SEPARATION AND SPECTROCHEMICAL DETERMINATION OF MICROGRAM QUANTITIES OF GERMANIUM IN NATURAL WATER OF HIGH HEAVY-METAL CONTENT,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02K.
W69-09684

02. WATER CYCLE

2A. General

NUMERIC STUDIES OF A COMPOSITE SOIL MOISTURE GROUNDWATER SYSTEM,
Drexel Inst. of Tech., Philadelphia, Pa.
For primary bibliographic entry see Field 02G.
W69-09462

DETERMINATION OF AQUIFER DIFFUSIVITY FROM AQUIFER RESPONSE TO FLUCTUATIONS IN RIVER STAGE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09467

SEPARATION OF RAINFALL EXCESS FROM TOTAL RAINFALL,
Washington State Univ., Pullman.
For primary bibliographic entry see Field 02B.
W69-09469

IN-PLACE DETERMINATION OF PERMEABILITY DISTRIBUTION FOR HETEROGENEOUS POROUS MEDIA THROUGH ANALYSIS OF ENERGY DISSIPATION,
Battelle Memorial Inst., Richland, Wash.
For primary bibliographic entry see Field 02F.
W69-09500

AREAL SWEEP EFFICIENCY OF PSEUDOPLASTIC FLUIDS IN A FIVE-SPOT HELE-SHAW MODEL,
Shell Development Co., Houston, Tex.
For primary bibliographic entry see Field 02F.
W69-09502

WATER RESEARCH PROGRAMS - AQUATIC COMMUNITIES,
Academy of Natural Sciences, Philadelphia, Pa. Dept. of Limnology.
For primary bibliographic entry see Field 06G.
W69-09508

THE USE OF SINGLE-PARAMETER DENSITY MODELS TO STUDY THE THERMOHALINE CIRCULATION IN AN OCEAN OF FINITE DEPTH,
University of the Far East.
V. F. Kozlov.
Atmos and Oceanic Phys, Vol 4, No 6, p 354-360, June 1968. 7 p, 2 fig, 1 tab, 26 ref. Transl from Izv, Akad Nauk, SSSR, Atmos and Okean Fiz, Vol 4, No 6, p 622-633, 1968.

Descriptors: Ocean circulation, *Salinity, *Density, *Mathematical models, Ocean currents, Diffusion, Mixing, Convection, Oceanography, Water circulation, Density currents.
Identifiers: USSR, Thermohaline circulation.

A general procedure is suggested for the use of single-parameter density models to solve the problem of the stationary circulation in an ocean of finite-depth. The equation obtained is solved numerically by computer. The depth distribution of the baroclinic layer in a rectangular ocean is computed. (Knapp-USGS)
W69-09509

CALCULATING THE GENERAL CIRCULATION AND CURRENTS IN THE NORTHWESTERN BLACK SEA,
Akademiya Nauk SSSR; and Gidrometeorologicheskii Institut, Odessa (USSR).
D. M. Tolmazin, and V. A. Shnaydman.
Atmos and Oceanic Phys, Vol 4, No 6, p 361-368, June 1968. 8 p, 8 fig, 1 tab, 13 ref. Transl from Izv, Akad Nauk, SSSR, Atmos and Okean Fiz, Vol 4, No 6, p 634-646, 1968.

Descriptors: *Ocean circulation, *Ocean currents, *Hydrologic budget, *Salinity, *Winds, *Inflow, Topography, Mass transfer, Mathematical models, Digital computers, Water circulation, Oceanography, Waves (Water).
Identifiers: *Black Sea, *USSR.

The general circulation in the northwestern Black Sea is calculated from the known wind field, river discharge, and bottom relief, taking account of the exchange of water with the open sea. A model of

steady homogeneous-fluid motion is used for the calculation. Observational data are used in making preliminary estimates of the horizontal grid spacing and of the accuracy of the solution. The stream function is calculated by Seidel's method. Patterns of the stream functions, surface currents, and free-surface relief are given for several wind situations in the northwestern Black Sea. Various factors affecting the process are analyzed. (Knapp-USGS)
W69-09510

METHODS OF STRUCTURAL AND GEOMORPHOLOGICAL ANALYSIS OF RIVER VALLEYS (RUSSIAN),
Kharkov State Univ. (USSR).
I. G. Chervanov.
Kharkov Univ, Vestnik Geol i Geogr, Ser No 25, No 2, p 83-85, 1967. 3 p.

Descriptors: *Geomorphology, *Mathematical studies, *Geologic control, *Structural geology, River basins, Topography, Slopes, Streamflow, Sediments, Floods, Maps, Mapping, Methodology.
Identifiers: *USSR, Terrace profile, Geomorphological methods.

Various structural and geomorphological elements of the Styr and Ikva River valleys were analyzed and plotted on the same map. These plotted elements consisted of (1) a longitudinal stream profile; (2) graphs characterizing the forms of transversal profiles; (3) geologico-geomorphological profiles of river terraces; and (4) the geomorphological scheme of the river valley. The longitudinal profiles of the rivers were analyzed using the concepts of deformation coefficient and coefficient of stream slope developed by Yu. A. Mescheryakov and then plotted on the map. The study shows that the combination of these geomorphological and geological profiles permits the evaluation of the tectonic processes acting in the past as well as the evaluation of the thicknesses and lithological characteristics of the formations present in a river valley. (Gabriel-USGS)
W69-09514

TECHNIQUES OF HYDROLOGIC RESEARCH IN FORESTED PEATLANDS, U.S.A.,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09571

QUICK-RETURN SUBSURFACE FLOW,
Agricultural Res Service, Beltsville, Md. Hydrograph Lab.; and Agricultural Research Service, Madison, Wis. Soil and Water Conservation Div.
For primary bibliographic entry see Field 02G.
W69-09665

A PRELIMINARY REPORT ON AN EMPIRICAL ANALYSIS OF DRAINAGE NETWORK ADJUSTMENT TO PRECIPITATION INPUT,
Idaho Univ., Moscow.
Roy E. Williams, and Phillip M. Fowler.
J Hydrol, Vol 8, No 2, p 227-238, June 1969. 12 p, 2 fig, 1 tab, 13 ref.

Descriptors: *Rainfall-runoff relationships, *Geomorphology, *Drainage density, Erosion, Hydrogeology, Streams, Terrain analysis, Topography, Model studies, Surveys, Discharge (Water), Streamflow.
Identifiers: Drainage basin analysis.

In an analysis of the effect of precipitation on drainage network adjustment and on cumulative stream discharge, seven 4th-order drainage basins in each of 2 areas were investigated. Both areas are covered by glacial till and have similar precipitation intensities and thunderstorm frequencies, but one area receives approximately 30% greater average annual precipitation than the other,. Values of certain geomorphic parameters were determined for each basin and these values were compared statistically. As might be expected from considerations based on Horton's law the number of segments per order per unit area of a 4th-order basin in the wetter area is systematically related to that in the drier area. The analysis indicates that a basin of a given order in the drier area contains more segments of every order than does a basin of the same order in the wetter area. But on a unit area basis more segments per order per unit area of 4th-order basins occur in the wetter area. Runoff data indicate that cumulative stream discharge per segment per order per unit area should be appreciably greater in the wetter area than in the drier area. On the basis of data collected from the 2 areas it appears that some variable other than precipitation, materials, evapotranspiration, and precipitation intensity is operative in the adjustment process. This variable may be initial relief. (Knapp-USGS)
W69-09671

A COMPREHENSIVE RAINFALL/RUNOFF MODEL FOR AN UPLAND CATCHMENT AREA,
Dee and Clwyd River Authority (Wales).
A. O. Lambert.
J. Inst Water Eng, Vol 23, No 4, p 231-238, June 1969. 8 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Routing, Streamflow forecasting, Recession curves, Hydrographs, Hydrograph analysis, Water storage, Streamflow, Water balance, Mathematical models, Model studies.
Identifiers: *Wales, Watershed models.

Using hydrometric data from an upland river in North Wales, a relationship between rate of river flow and water stored within the catchment area (catchment storage) is assumed to exist, and is evaluated from an analysis of winter recession curves. This storage/river flow relationship, when combined with water balance equations, produces a set of equations which may be used for routing inputs of rainfall through a storage with defined outflow characteristics, providing a straightforward method of flood prediction and analysis from rainfall data. Recorded and predicted flood hydrographs are compared, and the effectiveness and limitations of the method are considered. The development of a complete mathematical model, embodying the storage/river flow relationship, and suitable for generation of continuous run-off records from rainfall and evaporation data, is also considered. (Knapp-USGS)
W69-09674

CALIBRATING A WATERSHED BY USING A CLIMATIC DATA,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
Irvin C. Reigner.
USDA Forest Service, Research Paper NE-15, 45 p, illus, 1964.

Descriptors: *Hydrograph analysis, *Watershed management, *Calibrations, *Rainfall-runoff relationships, Storm runoff, Watersheds (Basin), Antecedent precipitation, Evapotranspiration, Climatic data, Pennsylvania, Estimating equations.
Identifiers: *Experimental watersheds, Hydrologic analysis, Groundwater storage, Soil moisture storage, Climatic variables.

In a single-watershed calibration of the experimental Dilldown Watershed in Pennsylvania, equations were developed for predicting annual runoff and monthly water loss or runoff. The basic relationships were developed from streamflow, climatic, groundwater, and soil-moisture records, but the final equations were expressed in terms of runoff and climatic variables only.
W69-09759

2B. Precipitation

PRODUCTION OF ISOLATED PAIRS OF WATER DROPS HAVING UNEQUAL RADII,
National Center for Atmospheric Research, Boulder, Colo.
For primary bibliographic entry see Field 07B.
W69-09448

CARBON-14 IN PATAGONIAN TREE RINGS,
Groningen Rijksuniversiteit (Netherlands). Physics Lab.
For primary bibliographic entry see Field 07B.
W69-09450

SEPARATION OF RAINFALL EXCESS FROM TOTAL RAINFALL,
Washington State Univ., Pullman.
David R. Scully, and Donald L. Bender.
Water Resources Res, Vol 5, No 4, p 877-883, Aug 1969. 7 p, 5 fig, 1 tab, 10 ref.

Descriptors: *Rainfall-runoff relationships, *Precipitation excess, Rainfall disposition, Hydrograph analysis, Infiltration, Water storage, Surface-groundwater relationships, Vegetation effects, Overland flow.
Identifiers: Rainfall excess calculation.

Twenty-seven unit hydrographys from the Ralston Creek basin in Iowa were used to develop a general dimensionless unit hydrograph. A dimensionless unit hydrograph procedure is used with excess rainfall rates to synthesize historic hydrographs of Ralston Creek. The distribution of the excess rainfall for 5-minute intervals is obtained when the computed storm hydrograph compares favorably with the historic storm hydrograph. Infiltration loss rates are obtained by separating excess rainfall rates from total rainfall. Infiltration loss rates are found to vary directly with the rainfall intensity and to be practically independent of time. It is suggested that surface detention is responsible for the increase in infiltration loss rates during heavy bursts of rainfall. Most water in surface detention is slowly released to direct runoff from its temporary storage when the rainfall moderates or stops. (Knapp-USGS)
W69-09469

INFERENCE OF STRATOSPHERIC TEMPERATURE AND MOISTURE PROFILES FROM OBSERVATIONS OF THE INFRARED HORIZON,
GCA Corp., Bedford, Mass.
F. B. House, and G. Ohring.
NASA, Langley Res Center Contract Rep Cr-1419, Aug 1969. 58 p, 19 fig, 8 tab, 10 ref, 1 append.

Descriptors: *Infrared radiation, *Atmospheric physics, *Remote sensing, *Moisture availability, *Research facilities, Temperature, Pressure, Water vapor, Clouds, Instrumentation, Methodology, Thermodynamic behavior, Design data, Statistical methods, Optical properties, Altitude, Satellites (Artificial).
Identifiers: *Atmospheric structure, *Data analysis, Instant inversion technique, Stratosphere.

This report presents results of theoretical research performed for the Langley Research Center and concerns the feasibility of inferring atmospheric temperature and moisture profiles from horizon radiances in the 15 micron carbon dioxide band and the water rotational band. Descriptions are given of investigations performed concerning inversion techniques, absorption band structures, error analyses, and problems related to instrument design. The instant inversion technique is developed and applied sucessfully to both theoretical radiance profiles and observed horizon radiances from Project Scanner. Analysis of these inversion results leads to a recommended measurement and data reduction technique for determination of temperature and moisture profiles in the stratosphere and lower mesosphere. Useful temperatures can be obtained at altitude ranges from

10 to 65 km and water vapor mixing ratios within the 10 to 50 altitude range. (Lang-USGS)
W69-09659

A PRELIMINARY REPORT ON AN EMPIRICAL ANALYSIS OF DRAINAGE NETWORK ADJUSTMENT TO PRECIPITATION INPUT,
Idaho Univ., Moscow.
For primary bibliographic entry see Field 02A.
W69-09671

2C. Snow, Ice, and Frost

WATER MOVEMENT AND FREEZING PRESSURES,
Army Terrestrial Sciences Center, Hanover, N.H. Earth Sciences Branch.
For primary bibliographic entry see Field 02G.
W69-09480

POORLY DRAINED SOILS WITH PERMAFROST IN INTERIOR ALASKA,
Army Terrestrial Sciences Center, Hanover, N.H.; and Dartmouth Coll., Hanover, N. H. Dept. of Earth Sciences.
For primary bibliographic entry see Field 02G.
W69-09486

THE EFFECT OF CHINOOK (FOEHN) ON SURFACE ABLATION OF ALIBEK GLACIER (RUSSIAN),
Kharkov State Univ. (USSR).
Z. P. Serbura.
Kharkov Univ, Vestnik Geol i Geogr, Ser No 25, No 2, p 104-105, 1967. 2 p, 1 tab, 4 ref.

Descriptors: *Glaciers, *Ablation, *Chinook, *Winds, Dry seasons, Atmospheric pressure, Air circulation, Anticyclones, Summer, Spring, Temperature, Humidity, Radiation, Snowmelt, Altitude.
Identifiers: *USSR, *Foehn ablation.

The effect of dry warm winds, the foehn, on surface ablation of glaciers is described on the basis of data collected in 1957 and 1958. Data were recorded on the night ice melt conditions at an altitude of 2005m. Maximum ablation effect was observed at air temperature of 10-12 deg C and humidity exceeding 30%. The ablation effect is decreased with an increase of temperature. (Gabriel-USGS)
W69-09515

GROWTH MODE OF ICE CRYSTALS IN AIR AT LOW PRESSURE,
Nagoya Univ. (Japan). Water Research Lab.
Kenji Isono, and Kunimoto Iwai.
Nature, Vol 223, No 5211, p 1149-1150, Sept 13, 1969. 2 p, 3 fig, 5 ref.

Descriptors: *Ice, *Crystal growth, *Cloud physics, Sublimation, Water properties, Laboratory tests, Crystals, Freezing, Condensation, Nucleation, Temperature, Pressure, Humidity.
Identifiers: *Ice clouds, Noctilucent clouds, Nacreous clouds.

In a study of the formation of noctilucent and nacreous clouds, ice crystals were grown on a metal surface in a vacuum cryostat. The cryostat was maintained at pressures from 0.1 to 0.000001 mm of Hg. At pressures lower than 0.1 mm, crystals grew in spherically symmetric, transparent, specular form. Neither edge growth nor skeleton structures were observed. Air bubbles were not included. With fixed values of supersaturation and temperature, radius increase was linear. At temperatures between -50 deg C and -80 deg C, values of the sublimation coefficient were about 0.06, and below 80 deg C the value increased with decreasing temperature. At pressures as low as .01 to .001 mm, ice particles are roughly spherical; needle-shaped crystals can apparently be grown only on needle-shaped nuclei. It is concluded that ice crystal growth in mesospheric and high-stratospheric conditions differs from growth in tropospheric conditions. This should be taken into account in the study of noctilucent and nacreous clouds. (Knapp-USGS)
W69-09651

EFFECT OF ICE CONCENTRATION ON THE SEA SURFACE TEMPERATURE,
Arkticheskii i Antarkticheskii Nauchno-Issledovatelskii Institut, Leningrad (USSR).
A. S. Denisov.
Transl by Scripta-Technica from Okeanologiya, Akad Nauk, SSR, Vol 8, No 4. Oceanology, Vol 8, No 4, p 473-476, 1968. 4 p, 1 fig, 4 tab, 1 ref.

Descriptors: *Water temperature, *Ice loads, *Statistical methods, Regression analysis, Correlation analysis, Sea ice, Seawater, Arctic.
Identifiers: *Ice concentration in sea, *Temperature forecasting, Arctic Sea.

Statistical relationships between surface water temperature and ice concentration were obtained in one of the Arctic Seas. As a general rule the greater the ice concentration, the lower the surface water temperature. Preliminary analysis of the data revealed regional differences in temperature for the same ice coverage which was greater from north to south than from east to west. Further, regression equations showed that the absolute effects of ice in determining the water temperature decreased from July to September. The decrease was particularly rapid at the beginning of the cooling period. The correlation coefficients for August and September were 0.40 and 0.32 respectively. This would indicate that other factors may be important in determining the relationships between surface water temperature and ice concentrations. These studies are important in developing charts of mean water temperature and in temperature forecasting necessary in navigation. (Carstea-USGS)
W69-09701

ROLE OF SOIL MOISUTRE IN THE HYDROLOGICAL CYCLE,
Ontario Agricultural Coll., Guelph. School of Agricultural Engineering.
For primary bibliographic entry see Field 02G.
W69-09705

2D. Evaporation and Transpiration

GENERATION OF AN EVAPORATION TIME SERIES FOR LAKE ONTARIO,
Cornell Univ., Ithaca, N.Y.
Shaw Lei Yu, and Wilfried Brutsaert.
Water Resources Res, Vol 5, No 4, p 785-796, Aug 1969. 12 p, 3 fig, 4 tab, 26 ref. OWRR Project A-009-NY.

Descriptors: *Evaporation, *Time series analysis, *Mass transfer, Hydrologic data, Statistical models, Hydrologic budget, Climatic data, Climatology, Lake Ontario.
Identifiers: Evaporation time series.

Monthly mean values of evaporation from Lake Ontario for the period from 1872 to 1965 inclusive were generated by a mass transfer procedure. Available onshore recorded meteorologic data were adjusted to obtain approximate over lake values with empirically derived equations. The mass transfer coefficient was calculated by using an equation proposed by Harbeck relating the coefficient with water surface area. A comparison of the generated mass transfer evaporation data with water budget estimates obtained by Morton revealed that on the average the 2 methods gave similar results. (Knapp-USGS)
W69-09461

EVAPORATION FROM A SIMULATED SOIL SHRINKAGE CRACK,
Agricultural Research Service, Temple, Tex. Soil and Water Conservation Research Div.; and Agricultural Research Service, Big Spring, Tex. Soil and Water Conservation Research Div.
John E. Adams, Joe T. Ritchie, Earl Burnett, and D. W. Fryrear.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 609-613, July-Aug 1969. 5 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Evaporation, *Soil moisture, *Cracks, *Shrinkage, *Laboratory tests, Model studies, Winds, Evaporation control, Mulching, Water conservation, Soil management, Water management (Applied).
Identifiers: Soil shrinkage cracks.

A simulated soil shrinkage crack, 46 cm wide and 62 cm deep, was constructed in such a manner that depth could be varied by 15.2-cm increments and width could be adjusted between 10 and 70 mm by 20-mm intervals. The walls of the crack were lined with porous ceramic plates connected to a water supply maintained at -5 mb potential. The simulated crack was installed in the floor of a laboratory wind tunnel located in a controlled environment room maintained at 24.0 C air temperature and 43% relative humidity. Evaporation from the simulated crack walls (ceramic plates) was determined for all combinations of four crack widths (10, 30, 50, and 70 mm), three crack depths (30, 45, and 60 cm) and five windspeeds (0, 2.2, 4.5, 6.7, and 8.9 m sec). Total water loss (evaporation) from the walls of the simulated crack increased as any one or all of the three variables (windspeed, crack depth, or crack width) increased. These three variables accounted for 99.1% of the variability in total evaporation from the crack walls. Turbulent air movement within the simulated crack was the major factor affecting the evaporation. Both straw and gravel mulches reduced evaporation from the crack walls 85 to 90% with no wind and about 60% at 8.9 m per sec windspeed. The results suggest that evaporation from soil shrinkage cracks may be reduced by closer plant or row spacing or by surface residues such as trash and clod mulches. Total evaporation from a simulated crack 60 cm deep varied from 0.5 cm per hr (10 mm wide, 0 m per sec windspeed) to 18 cu m per hr (70 mm wide, 8.9 m per sec windspeed). In simulated cracks 60 cm deep and 30-70 mm wide, 50-60% of the total evaporation occurred below 15 cm and 30-40% occurred below 30 cm. (Knapp-USGS)
W69-09488

EVAPOTRANSPIRATION FROM TWO PEATLAND WATERSHEDS,
Forest Service (USDA), Grand Rapids, Minn. North Central Experiment Station.
Roger R. Bay.
Int Ass Sci Hydrol Pub No 78, Gen Assembly of Bern, Sept-Oct 1967, p 300-306, 1967. 7 p, 1 fig, 4 tab, 14 ref.

Descriptors: *Evapotranspiration, *Bogs, *Water balance, *Swamps, *Peat, Evaporation, Transpiration, Water table, Water level fluctuations, Saturated soils, Streamflow, Consumptive use, Minnesota.
Identifiers: *Peatlands, Spruce forests, Potential evapotranspiration.

Measurements of precipitation, runoff, and bog water table levels have provided data for the calculation of evapotranspiration from two forested peatland watersheds near Grand Rapids, Minnesota (ca. 47 deg 31 min N, 93 deg 28 min W). Continuous hydrologic records were collected on one experimental bog for 6 years (1961-1966) and on the other for the past 2 years (1965-1966). Water level changes in each bog were converted to inches-depth of storage by water yield coefficients for specific peat horizons and used to adjust precipitation-runoff calculations. Evapotranspiration estimates for the growing-season period May 1 to November 1 ranged from 87 to 121 percent of potential evapotranspiration computed by the

Thornthwaite method. Midsummer evapotranspiration totals (June 1 to September 1) were 70 to 99 percent of potential evapotranspiration. Mean daily evapotranspiration values from both bogs during short summer drying periods were consistently less than the calculated potential values.
W69-09572

POTENTIAL EVAPOTRANSPIRATION AND CLIMATE IN ALASKA BY THORNTHWAITE'S CLASSIFICATION,
Pacific Northwest Forest and Range Experiment Station, Juneau, Alaska. Inst. of Nothern Forestry; and State Univ., of New York, Syracuse. Dept. of Watershed Management.
James H. Patric, and Peter E. Black.
US Forest Serv Res Pap PNW-71, 1968. 28 p, 4 fig, 2 tab, 19 ref.

Descriptors: *Evapotranspiration, *Alaska, Water balance, Hydrologic budget, Humidity, Climates, Temperature, Cold regions, Data collections, Climatic data.
Identifiers: *Thornthwaite method.

Estimates and measurements of potential evapotranspiration in Alaska by Thornthwaite's methods showed good agreement with estimates and measurements by other methods. Natural vegetation is closely related to climate. Vegetation distribution in the interior seems governed more by temperature than by moisture availability. The available data heavily bias classifications of climate to sea-level and valley-bottom conditions. (Knapp-USGS)
W69-09698

A METHOD OF ESTIMATING STREAMFLOW LOSS BY EVAPOTRANSPIRATION FROM THE RIPARIAN ZONE,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
Irvin C. Reigner.
Forest Science, Vol 12, No 2, June 1966.

Descriptors: *Evapotranspiration, *Riparian water loss, *Watersheds (Basins), Diurnal distribution, Streamflow forecasting, Hydrograph analysis, Base flow, Low flow, Surface-groundwater relationships, Estimating equations, Pennsylvania.
Identifiers: *Experimental watersheds, Hydrologic analysis.

Conservative values of daily streamflow loss by evapotranspiration from the riparian zone were obtained by hydrograph analysis. The two highest peaks of a series of diurnal fluctuations were connected by a straight line, representing the potential groundwater flow for a series of days between storm flows. The series should ideally be no longer than 5 days. After sufficient number of daily riparian water losses were obtained, they were used as observations for the dependent variable in multiple-regression analysis. In this investigation, 62 samples, occurring during June, July, and August in 1955 and 1956, were used. An estimating equation was derived, using as predictor variables: (1) the one-half powers of mean daily streamflow in c.f.s., and (2) the one-half powers of weighted vapor-pressure deficit. The two individual variables were subsequently eliminated by their product interaction. The equation estimated riparian water loss with a relatively high degree of accuracy; 76 percent of the total variation was removed by the single complex variable.
W69-09760

2E. Streamflow and Runoff

ON THE RANDOM OCCURRENCE OF MAJOR FLOODS,
Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 06A.
W69-09460

CLOGGING IN SURFACE SPREADING OPERATIONS FOR ARTIFICIAL GROUNDWATER RECHARGE,
Agricultural Research Service, Fresno, Calif. Groundwater Recharge Field Station.
For primary bibliographic entry see Field 04B.
W69-09468

A NOTE ON MORAN'S PROBABILITY THEORY OF DAMS AND STORAGE SYSTEMS,
City Univ., London (England).
For primary bibliographic entry see Field 04A.
W69-09470

A COMBINED CONTROL-METERING SECTION FOR GAGING LARGE STREAMS,
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest Range Experiment Station.
For primary bibliographic entry see Field 07B.
W69-09471

SOME EFFECTS OF MAN-MADE CONTROLS IN THE UPPER REACHES OF A SMALL DRAINAGE BASIN,
Mississippi State Univ., State College. Dept. of Civil Engineering; and Mississippi State Univ., State College. Water Resources Research Inst.
For primary bibliographic entry see Field 04A.
W69-09491

FLOOD PLAIN INFORMATION, EAST FORK WHITE RIVER AND TRIBUTARIES, VICINITY OF COLUMBUS, INDIANA.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W69-09496

FLOOD PLAIN INFORMATION-COASTAL FLOODING AT HAMPTON, VIRGINIA.
Corps of Engineers, Norfolk, Va.
For primary bibliographic entry see Field 04A.
W69-09497

INVESTIGATIONS OF SURFACE AND GROUNDWATER RUNOFF (RUSSIAN),
M. F. Skribnyy, V. T. Turchinovich, I. A. Kuznetsov, G. P. Yunusov, and N. N. Favorin.
Moscow, Akad Nauk, 1967. 187 p.

Descriptors: *Surface runoff, *Groundwater movement, Floods, Water resources, Mathematical studies, Water balance, Economics, Agriculture, Agricultural engineering, Discharge (Water), Watersheds (Basins), Seawater, Filtration, Rain, Snow, Mudflows, Obstruction to flow, Monsoons.
Identifiers: *USSR, Groundwater runoff.

A collection is presented of 13 articles on groundwater and surface runoffs on the basis of analytical and experimental studies conducted by USSR investigators. The collection contains the following articles: (1) Physicotechnical problems for mastering water resources, by M. F. Skribnyy; (2) a method of working out a water economy balance, by V. T. Turchinovich; (3) the meaning of water-economy balance in rational utilization of water resources, by I. A. Kuznetsov; (4) stability of normal annual runoffs and seasonal river discharges under conditions of the development of agrotechnical measures in the watershed, by G. P. Yunusov; (5) groundwater regime change as a method of preventing seawater incursion, by N. N. Favorin; (6) analysis of flood processes in watersheds characterized by filtration phenomenon, by M. F. Skribnyy; (7) generalized expression for a connection between the kinematic and morphologic elements of stream flow, by G. V. Zheleznyakov; (8) analysis of rainflood development in small basins, by I. L. Zimont; (9) calculation of maximum water discharges of rain and snow originally G. V. Zheloznyakov and B. B. Danilevich; (10) mud flows in the Transilian Ala. Tau and mud-flow catastrophe in the Issyk river of 7 July, 1963, by G. D. Rozhdestvenskiy; (11) some means for mudflow prevention, by I. I. Mechitov; (12) Zeravshan river obstruction of 24 April, 1964, by G. D. Rozhdestvenskiy; and (13) analytical method of calculation of Monsoon floods, by M. F. Skribnyy. (Gabriel-USGS)
W69-09511

AERIAL PHOTOGRAPHS FOR OPERATIONAL STREAMFLOW FORECASTING IN THE COLORADO ROCKIES,
Forest Service, Fort Collins, Colo.
For primary bibliographic entry see Field 07B.
W69-09539

A 2-YEAR EVALUATION OF THE SNOWMELT LYSIMETER,
Forest Service (USDA), Moscow, Idaho.
For primary bibliographic entry see Field 07B.
W69-09545

CHARACTERISTIC RESPONSE TIMES IN DESIGN FLOOD ESTIMATION,
New South Wales Univ., Kensington (Australia); and Ministry of Public Works (Cambodia).
Federick C. Bell, and Songthara Om Kar.
J Hydrol, Vol 8, No 2, p 173-196, June 1969. 24 p, 8 fig, 6 tab, 21 ref.

Descriptors: *Rainfall-runoff relationships, *Flood forecasting, *Design flood, *Routing, Streamflow forecasting, Water management (Applied), Hydrographs, Unit hydrographs, Hydrograph analysis, Mathematical models, Estimating.
Identifiers: Watershed response time.

In design flood estimation, characteristic response times are required for the determination of hydrograph parameters and critical durations of flood-producing rainfall. Dimensionless hydrographs are useful for design purposes and it appears that most of these may be approximated by a single, simple mathematical equation expressed in terms of the rise time or time to peak. The rise time, time of concentration, lag, time to equilibrium, and volume/peak ratio have been suggested as appropriate characteristic times. These should be governed mainly by the physical configurations of the catchments concerned but some are evidently also affected significantly by the storm types, and durations and intensities of rainfall. The critical lag is suggested as a convenient characteristic time that may be related to each of the other characteristic times. Under most circumstances the critical lag is a suitable value for the critical duration of design rainfall. Several equations for estimating characteristic times from catchment parameters are presented but none of these is completely satisfactory. (Knapp-USGS)
W69-09667

HYDROLOGIC RESEARCH FOR WATERSHED ENGINEERING,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 04D.
W69-09669

A PREFABRICATED FLAT-VEE WEIR FOR EXPERIMENTAL CATCHMENTS,
Durham Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 07B.
W69-09670

INDIANA AGRICULTURAL IRRIGATION IN 1967,
Indiana Dept. of Natur Resources, Indianapolis. Water Planning Section; and Purdue Univ., Lafayette, Ind. Agriculture Extension Service.
For primary bibliographic entry see Field 03F.
W69-09680

EXTENT AND FREQUENCY OF FLOODS IN UPPER MILLSTONE RIVER BASIN IN THE VICINITY OF HIGHTSTOWN, N.J.,
Geological Survey, Trenton, N.J.
George M. Farlekas.
Geol Surv Open-file Rep, Feb 1969. 57 p, 25 fig, 1 plate, 5 tab, 20 ref.

Descriptors: *Floods, *New Jersey, *Flood plains, Discharge (Water), Stage-discharge relations, Surface waters, Streamflow, Hydrographs, Profiles, Data collections, Hydrologic data.
Identifiers: Hightstown (NJ), Millstone River.

Flooding of the Upper Millstone River basin near Hightstown, New Jersey is described. Data are presented on the extent, depth, and frequency of flooding. Extent of flooding is shown by maps, profiles, and cross sections. (Knapp-USGS)
W69-09682

HYDROLOGIC SIGNIFICANCE OF 1966 FLOOD LEVELS AT LAKE JACKSON NEAR TALLAHASSEE, FLORIDA,
Geological Survey, Washington, D.C.
Gilbert H. Hughes.
Geol Surv Hydrol Invest Atlas HA-369, 1 sheet, 1969. Text, 9 fig, 1 map, 3 tab, 4 ref.

Descriptors: *Water levels, *Lakes, *Florida, Hydrologic budget, Rainfall, Floods, Hydrographs, Hydrogeology, Aquifers, Groundwater movement.
Identifiers: Lake Jackson (Tallahassee, Fla).

In 1966, the water level of Lake Jackson, Tallahassee, Florida, reached its highest level since 1886. The lake is supplied with water only by direct rainfall and local runoff, and loses water by evaporation and leakage to an underlying confined limestone aquifer which always has a head lower than lake level. Recurrence intervals of lake stages were established by dating the killing of oak trees by inundation of their roots. Hydrographs show yearly rainfall, runoff of nearby rivers, and lake stages. (Knapp-USGS)
W69-09688

FLOODS ALONG LITTLE CALUMET RIVER AND TRIBUTARIES, ILLINOIS AND INDIANA.
Corps of Engineers, Chicago, Ill.
For primary bibliographic entry see Field 04A.
W69-09689

ON OBJECTIVE APPROACH TO DEFINITIONS AND INVESTIGATIONS OF CONTINENTAL HYDROLOGIC DROUGHTS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Vujica M. Yevjevich.
Colo State Univ Hydrol Pap No 23, Aug 1967. 19 p, 9 fig, 1 tab, 12 ref.

Descriptors: *Droughts, *Forecasting, *Statistical methods, Stochastic processes, Precipitation (Atmospheric), Time series analysis, Regression analysis, Monto Carlo method, Mathematical models, Synoptic analysis.
Identifiers: Statistical runs, Continental droughts.

Methods are outlined for an objective definition of large continental droughts. The phenomenon determining drought, the variable which properly describes this phenomenon, the moisture level at which a drought starts, and the area to which a drought is related are defined. Runs as statistical properties of time and space distribution of water deficits are recommended as parameters for drought definition. Run-length of negative deviations of a time series (duration of drought) run-sum of negative deviations between a downcross and an upcross of a time series (severity of a drought) and area-run as the deficit of water over a time duration (run-length), and area drought are proposed as definitions of droughts. The runs can be determined either analytically for simple cases or by the Monte Carlo Method for more complex cases. Examples for these 2 methods are given. A review is made of results obtained at Colorado State University in the last 4 to 5 yr on the properties of precipitation, effective precipitation and runoff which affect the description of droughts and the outlook for drought prediction. An approach is proposed for prediction of large continental droughts by the search for an interrelationship of oceanic synoptic situation and continental precipitation. Some measures are explored which offer a possibility for combating large droughts. (Knapp-USGS)
W69-09704

WATER RESOURCES OF PULASKI AND SALINE COUNTIES, ARKANSAS,
Geological Survey, Washington, D.C.
Raymond O. Plebuch, and Marion S. Hines.
Geol Surv Water-Supply Pap 1839-B, p B1-B25, 1967. 25 p, 2 fig, 1 plate, 5 tab, 27 ref.

Descriptors: *Water resources, *Arkansas, Groundwater, Surface waters, Streamflow, Rivers, Reservoirs, Water yield, Water wells, Water quality, Aquifers, Hydrogeology, Hydrologic data, Data collections.
Identifiers: Pulaski County (Ark), Saline County (Ark).

Pulaski and Saline Counties constitute an area of 1,506 sq mi in the geographic center of Arkansas. The area is divided into a hilly western part, known as the Interior Highlands, and a relatively flat eastern part, known as the Coastal Plain. In the Interior Highlands, surface water offers greater possibilities than groundwater for water supplies. Alum Fork, Middle Fork, and North Fork of the Saline River offer excellent impoundment possibilities and will yield water of good quality. In addition, with storage, many of the smaller streams are suitable for development of small supplies. In contrast, in the Coastal Plain it is easier to develop groundwater than surface water in relatively large quantities. Two aquifers, units 3 and 9, yield as much as 350 and 2,000 gpm of water, respectively. A third aquifer, unit 7, is as yet relatively undeveloped in the project area, but yields 860 gpm to a well south of the project area. These aquifers yield water that, with treatment, is suitable for most uses. (Knapp-USGS)
W69-09711

ACCURACY OF DISCHARGE DETERMINATIONS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
W. T. Dickinson.
Colo State Univ Hydrol Pap No 20, June 1967. 54 p, 11 fig, 17 tab, 122 ref. 14-06-D-6007 (Bur Reclam).

Descriptors: *Discharge measurement, *Streamflow, *Discharge (Water), *Reviews, *Bibliographies, Mathematical studies, Statistical methods, Calibrations, Stage-discharge relations, Correlation analysis.
Identifiers: Rating curves.

Errors that may be incurred in discharge determinations made on mountain streams were analyzed. The possible sources of error were carefully considered, and a classification of these sources, including notations on the nature of the resulting errors, was prepared. A mathematical error model for a single discharge measurement was hypothesized, and methodology presented for the evaluation of daily, monthly, and annual discharge estimates. An exhaustive literature review was made. Each component was analyzed separately, and with respect to the others, in order to yield information about the random or systematic nature of the error, and about possible functional relationships which might be involved. This information has been summarized in the form of a classification of errors. A hypothetical error model was developed for a single discharge measurement to reveal the manner of combination of the various component errors, and to clarify the nature of some of the errors. Finally, consideration was given to the errors arising from use of an estimated rating curve, which accounts for virtually all the variability in sample data for 9 mountain stream-gaging stations in Colorado. Rating curves can be separated into two portions, one along which the relative error was virtually constant, and the other along which the absolute error remained constant. Confidence and tolerance limits were established for the estimated curves, and are used for inferences regarding the error bounds on daily discharge estimates and future discharge measurements. (Knapp-USGS)
W69-09713

ENGINEERING JUDGMENT AND SMALL AREA FLOOD PEAKS,
Colorado State Univ., Fort Collins.
Lourens A. V. Hiemstra, and Brian M. Reich.
Colo State Univ Hydrol Pap No 19, Apr 1967. 29 p, 11 fig, 9 tab, 25 ref. Bureau of Reclamation Contract 14-11-0008-0590-62.

Descriptors: *Flood forecasting, *Reviews, *Rainfall-runoff relationships, *Streamflow forecasting, *Runoff forecasting, Rational formula, Small watersheds, Rainfall intensity, Routing, Estimating.
Identifiers: Flood records.

The knowledge of small basin floods and the state of the art of flood predictions on ungaged basins are such that engineering judgement still plays an important role in the determination of a design flood. An appraisal of the reliability of 5 current methods of flood prediction is presented as an aid in developing this faculty. Flood estimates obtained by applying rainstorms estimated to have return periods of from 2- through 200-years were compared. For each of 6 such levels applied to 14 real basins, inconsistencies among 5 methods produced differences in the magnitude of their estimates as great as 300%. Since long flood records for small basins were inadequate, it was necessary to insert observed rainfalls into formulae and design methods. Design estimates based upon recorded rainstorms were compared to 134 observed floods, on 45 mixed-cover agricultural basins ranging in area from 0.12 through 8.16 sq mi. Scatter-diagrams, histograms, and statistics suggest some superiority of the 'Rational' formula, the Bureau of Public Roads method, and the Tacitly Maximized Peak technique in that they generally overestimate floods from this sample. Although variability is less than that of the other 2 methods, underprediction is possible in about a third of the cases. (Knapp-USGS)
W69-09714

UNSTEADY FLOW SIMULATION IN RIVERS AND RESERVOIRS,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 07C.
W69-09725

DIGITAL COMPUTER SIMULATION OF TRANSIENT FLOWS IN THE TVA SYSTEM,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 08B.
W69-09726

QUALITY OF SURFACE WATER IN ILLINOIS, 1956-1966,
Illinois State Water Survey, Urbana. Water Supply Div.
Robert H. Harmeson, and T. E. Larson.
Ill State Water Survey, Urbana, Bull 54, 1969. 184 p, 15 ref.

Descriptors: Alkalinity, Fluoride, *Illinois streams, Manganese, Mineral quality, Nitrate, Phosphate, Radioactivity, Surface water, Temperature, *Total dissolved minerals, Total hardness, Turbidity, *Water quality.

Surface water quality in Illinois has been determined by means of analysis of data from monthly water sampling programs. Sampling programs have spanned periods of approximately 5 years and have been carried on since 1945 for 61 locations on 45 streams and 1 lake. Data analyzed to show frequencies of median and extreme values of certain mineral constituents for specific streams and sampling periods provide base-line values for future water quality and water resource studies. Comparisons are drawn between water quality for the same stations in two or more sampling periods and also for streams or stations in different geographic or physiographic sections of the state. Attention is drawn to temporal changes in mineral constituents and to potential water quality problems.
W69-09739

2F. Groundwater

NUMERIC STUDIES OF A COMPOSITE SOIL MOISTURE GROUNDWATER SYSTEM,
Drexel Inst. of Tech., Philadelphia, Pa.
For primary bibliographic entry see Field 02G.
W69-09462

THEORY OF FLOW IN A CONFINED TWO AQUIFER SYSTEM,
California Univ, Berkeley.
Shlomo P. Neuman, and Paul A. Witherspoon.
Water Resources Res, Vol 5, No 4, p 803-816, Aug 1969. 14 p, 9 fig, 22 ref.

Descriptors: *Groundwater movement, *Aquifers, *Aquitards, *Mathematical models, Drawdown, Permeability, Leakage, Water levels, Withdrawal, Pumping, Water storage, Discharge (Water).
Identifiers: Leaky aquifers, 2-aquifer flow system.

A complete analytic solution has been developed for the problem of flow to a well in a confined infinite radial system composed of 2 aquifers that are separated by an aquitard. The well, which is represented by a line sink, completely penetrates only one of the aquifers and discharges at constant rate. The present solution differs from previous work in that the effects of storage in the aquitard and drawdown in the unpumped aquifer are both considered. Asymptotic solutions for small values of time are also included. The analytic solutions have been evaluated numerically for selected cases. The validity of these solutions has been verified independently using the finite element method of analysis. (Knapp-USGS)
W69-09463

APPLICABILITY OF CURRENT THEORIES OF FLOW IN LEAKY AQUIFERS,
California Univ., Berkeley.
Shlomo P. Neuman, and Paul A. Witherspoon.
Water Resources Res, Vol 5, No 4, p 817-829, Aug 1969. 13 p, 9 fig, 38 ref.

Descriptors: *Groundwater movement, *Aquifers, *Aquitards, *Leakage, *Mathematical models, Drawdown, Permeability, Water levels, Withdrawal, Pumping, Water storage, Discharge (Water), Analytical techniques.
Identifiers: *Leaky aquifer theory.

The applicability of current theories of flow in leaky aquifers has been investigated using new analytic and numeric solutions. In general it has been customary to use one or both of the following assumptions: (1) storage in the aquitards is negligible, and (2) drawdowns in the unpumped aquifers remain zero. At small values of time the first-assumption amounts to neglecting the effects of leakage completely. Errors introduced in this way can become significant when the Beta factor of Hantush exceeds 0.01. It appears that Beta may exceed 0.1 in many field situations. At large values of time, neglecting drawdowns in the unpumped aquifers can also lead to serious errors unless the transmissibilities of these aquifers are significantly greater than that of the pumped aquifer. In addition present methods of analyzing leaky aquifers usually rely only on drawdown data from the pumped aquifer. Such an approach is not sufficient to characterize a leaky system; current methods of analyzing field data from leaky aquifers need to be improved. (Knapp-USGS)
W69-09464

EFFECTS OF BOUNDARY CONDITIONS OF MODELS ON TRACER DISTRIBUTION IN-FLOW THROUGH POROUS MEDIUMS,
Weizmann Inst. of Science, Rehovoth (Israel).
N. D. Gershon, and A. Nir.
Water Resources Res, Vol 5, No 4, p 830-839, Aug 1969. 10 p, 3 fig, 1 tab, 21 ref.

Descriptors: *Groundwater movement, *Flow, *Porous media, *Tracers, Diffusion, Dispersion, Radioactivity effects, Chemical reactions, Mathematical models, Mathematical studies, Hydraulics, Steady flow, Unsteady flow, Distribution.
Identifiers: Tracer behavior in porous media.

Effects of initial and boundary conditions on the distribution of the tracer in time and distance are calculated for several one-dimensional systems (infinite, semi-infinite, and finite) of tagged liquid flowing through a solid matrix, and the effects of hydrodynamic dispersion, diffusion, radioactive decay, and simple chemical interactions of the tracer are included. Exact and approximative solutions show that in most practical conditions the results of steady state experiments are influenced only up to 0.5% by changes in boundary conditions. In nonsteady state, results are influenced up to 5% in the region where the ratio of the measured concentration and the concentration of the solution entering the porous medium is about 0.5. Results are given in non-dimensional form with graphs of representative cases. (Knapp-USGS)
W69-09465

DIFFUSION OF TRAPPED GAS FROM POROUS MEDIA,
Manitoba Univ., Winnepeg; Idaho Univ., Moscow; and Colorado State Univ., Fort Collins.
Kenneth M. Adam, George L. Bloomsburg, and Arthur T. Corey.
Water Resources Res, Vol 5, No 4, p 840-849, Aug 1969. 10 p, 8 fig, 2 tab, 7 ref.

Descriptors: *Flow, *Gases, *Liquids, *Porous media, *Wetting, Groundwater movement, Infiltration, Permeameters, Laboratory tests, Model studies, Hydraulic models, Unsaturated flow, Saturated flow, Diffusion, Porosity, Permeability.
Identifiers: Multiphase flow.

When a gas-filled porous medium is permitted to imbibe liquid from a source at a pressure equal to the initial gas pressure, some of the gas is trapped in the pores and is discontinuous with the atmosphere surrounding the medium. The amount of gas initially trapped varies over a range at least as wide as from about 5 to about 50% of the pore volume. The percentage of trapped gas is gradually reduced to zero as the gas diffuses away under the influence of capillary compression. This happens even though the imbibed liquid is presaturated with the gas initially trapped. Porous media become completely saturated with liquid first at exposed surfaces, and the zone of complete saturation moves continuously toward the interior. (Knapp-USGS)
W69-09466

DETERMINATION OF AQUIFER DIFFUSIVITY FROM AQUIFER RESPONSE TO FLUCTUATIONS IN RIVER STAGE,
Geological Survey, Washington, D.C.
George F. Pinder, John D. Bredehoeft, and Hilton H. Cooper, Jr.
Water Resources Res, Vol 5, No 4, p 850-855, Aug 1969. 6 p, 4 fig, 9 ref.

Descriptors: *Surface-groundwater relationships, *Induced infiltration, *Diffusivity, Hydrologic properties, Aquifers, Permeability, Stage-discharge relations, Hydrograph analysis, Mathematical models, Digital computers, Simulation analysis.
Identifiers: Aquifer diffusivity, Pumping tests, Aquifer tests.

The diffusivity of a homogeneous isotropic aquifer can be determined from the response in the aquifer to fluctuations in river stage. Observed changes in head in the aquifer are compared with theoretic head values computed assuming a series of diffusivities. These values are generated by approximating the stage hydrograph as a series of discrete steps and summing the influence of each increment. The diffusivity of the aquifer is calculated from the best-fitting theoretic response curve. Diffusivities computed for an aquifer at Musquodoboit Harbour, Nova Scotia, agree with values determined from pumping test and digital model analysis. (Knapp-USGS)
W69-09467

CLOGGING IN SURFACE SPREADING OPERATIONS FOR ARTIFICIAL GROUNDWATER RECHARGE,
Agricultural Research Service, Fresno, Calif. Groundwater Recharge Field Station.
For primary bibliographic entry see Field 04B.
W69-09468

A CORRESPONDENCE PRINCIPLE FOR THE THEORY OF LEAKY AQUIFERS,
Universidad Nacional Autonoma de Mexico, Mexico City. Instituto de Geofisica.
Ismael Herrera, and German E. Figueroa.
Water Resources Res, Vol 5, No 4, p 900-904, Aug 1969. 5 p, 1 fig, 5 ref.

Descriptors: *Groundwater movement, *Aquifers, *Aquitards, *Leakage, Water levels, Drawdown, Pumping, Mathematical models, Water storage, Water yield.
Identifiers: Leaky aquifer theory.

A correspondence principle for leaky aquifers in which the storage in the confining layers is taken into consideration associates an imaginary equivalent nonleaky aquifer with every leaky aquifer. It is valid for long periods of operation. Using this principle, the study of the leaky aquifers is reduced to the study of the corresponding nonleaky aquifers. When the quality of the approximation is tested by applying it to an isolated well, complete agreement with results obtained by other methods is found. The principle is suitable for application to numeric studies of regional evolution of piezometric heads. (Knapp-USGS)
W69-09473

THERMAL AND ELECTRICAL CONDUCTIVITIES OF SANDSTONE ROCKS AND OCEAN SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Oceanography; and National Academy of Sciences-National Research Council, Washington, D.C. Div. of Earth Sciences.
Jeremy R. Hutt, and Joseph W. Berg, Jr.
Geophysics, Vol 33, No 3, p 489-500, June 1968. 12 p, 4 fig, 3 tab, 17 ref, 3 append. Contract No 1286 (10) ONR. Grant No GP 4642 NSF.

Descriptors: *Conductivity, *Thermal conductivity, *Electrical conductance, *Electrical studies, *Rocks, *Sediments, Hydraulic conductivity, Permeability, Porosity, Sandstones, Mineralogy.
Identifiers: Thermal-electric conductivity relationships.

Relationships between electrical and thermal conductivities of consolidated sandstone rocks and sediments were investigated. Equations given by Archie and by Woodside and Messmer combined to give an equation which relates the 2 conductivities for the rocks. Equations relating conductivity and porosity, given by Maxwell, Bruggeman, and Woodside and Messmer were combined to give 2

equations which relate thermal and electrical conductivities for sediments. Data from 65 rock samples and 105 sediment samples were used in establishing the reliability and parameter values of the equations. The derived equation can be used to determine thermal conductivities from electrical conductivities, providing thermal conductivities of the solid constituents can be approximated. For samples of sandstone rock, deviations of the data from values predicted by the equations are shown to be related to the variations in composition of the samples. Within the accuracy of the data, the thermal conductivities of sediment samples seem to be controlled more by the water content than by the mineral composition. (Knapp-USGS)
W69-09498

TRANSIENT PRESSURE TESTING OF FRACTURED WATER INJECTION WELLS,
Pan American Petroleum Corp., Tulsa, Okla.
K. K. Clark.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 1, p 639-643, 1968. 5 p, 8 fig, 3 tab.

Descriptors: *Rock mechanics, *Fractures (Geology), *Injection wells, *Pressure, Mathematical models, Productivity, Water yield, Mathematical studies, Model Studies, Permeability, Boreholes, Aquifers, Carbonates, Filters, Parametric hydrology.
Identifiers: Hydraulic fracturing, West Texas oil-producing area.

Because injection pressures in water injection wells may create deeply penetrating fractures, a method of calculating fracture lengths from pressure fall-off test data was developed on the basis of analytical studies and experimental data recorded using models and the West Texas injection wells. The method is based on a linear flow model that stimulates conditions present during the early-time period after shutting in an injection well. Fracture length calculation procedure for pressure fall-off test data provides good estimates of true fracture length when applied to generated test data. Fracture lengths calculated from field measured data appear to be reasonable. (Gabriel-USGS)
W69-09499

IN-PLACE DETERMINATION OF PERMEABILITY DISTRIBUTION FOR HETEROGENEOUS POROUS MEDIA THROUGH ANALYSIS OF ENERGY DISSIPATION,
Battelle Memorial Inst., Richland, Wash.
R. William Nelson.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 33-42, 1968. 10 p, 4 fig, 8 ref.

Descriptors: *Porous media, *Permeability, *Mathematical studies, *Energy dissipation, *Computer programs, Heterogeneity, Saturated flow, Streamflow, Fluid mechanics, Porosity, Isotropy, Digital computers, Mapping.
Identifiers: Grand View (Idaho).

The theoretical basis is presented for energy dissipation methods of measuring permeability in saturated heterogeneous media. Analysis starts with the equation for single-phase flow in heterogeneous porous media which is a first-order partial differential equation in the unknown permeability. This equation is reduced to a system of characteristic equations useful in deriving a differential expression for the permeability as a function of the known potential distribution. For steady flow systems the expression is integrable, giving the permeability integral for direct calculation of the distribution along successive stream lines. The boundary condition in permeability is presented and includes a discussion of the special requirement to assure uniqueness. Theoretical results and necessary computations are incorporated into two general computer programs capable of determining the permeability distribution in 2- and 3-dimensional steady flow systems. Results are then presented for an energy dissipation analysis using the methods and software to determine a field permeability thickness distribution. (Gabriel-USGS)
W69-09500

STEADY-STATE FLOW CAPACITY OF WELLS WITH LIMITED ENTRY TO FLOW,
Mobil Research and Development Corp., Dallas, Tex.
A. S. Odeh.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 43-51, 1968. 9 p, 10 fig, 3 tab, 8 ref, 1 append.

Descriptors: *Aquifers, *Steady flow, *Flow rates, *Water wells, *Flow characteristics, Mathematical studies, Computer programs, Computers, Water supply, Pressure, Boreholes, Water loss, Productivity, Drainage wells, Anistropy, Porous media.
Identifiers: Steady-state flow capacity of wells.

The effect of limited entry to flow at the borehole on the steady-state production of a well is analyzed on the basis of analytical studies of earlier publications and well data. The finite cosine transform was used to arrive at a solution for steady-state flow of a slightly-compressible flow and the solution was programmed for a digital computer. The correct calculation of skin and damage ratio in the presence of limited entry to flow is outlined and calculation of the net decrease in productivity due to the combined effect of limited entry and performations is explained. (Gabriel-USGS)
W69-09501

AREAL SWEEP EFFICIENCY OF PSEUDOPLASTIC FLUIDS IN A FIVE-SPOT HELE-SHAW MODEL,
Shell Development Co., Houston, Tex.
K. S. Lee, and E. L. Claridge.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 52-62, 1968. 11 p, 9 fig, 3 tab, 36 ref, append.

Descriptors: *Fluid mechanics, *Efficiencies, *Mathematical studies, *Model studies, *Groundwater movement, Velocity, Water circulation, Viscosity, Viscous flow, Oil, Oily water, Porous media, Isotropy, Saturated flow, Tension, Parametric hydrology.
Identifiers: Pseudoplastic fluids, Areal sweep efficiency.

Areal sweep efficiency of oil displacement by enhanced-viscosity water exhibiting pseudoplastic behavior was measured in a Hele-Shaw model representing one-quarter of a five-spot pattern. The pseudoplasticity of polymer solutions and the velocity distribution in the five-spot pattern produced a condition under which the mobility ratio between the displacing and the displaced fluid could not be assigned a single value. Instead, the movement of the displacement front is governed by local mobility ratios which are also time dependent. The areal sweep at breakthrough with polymer solutions was poorer than the sweep obtained with Newtonian fluids of comparable viscosity. However, the areal sweep a 1 PV throughput was greatly improved as compared to flood water without polymer. It was also demonstrated that, even after the oil-cut had declined to a low value during a regular waterflood, switching to polymer flood efficiently swept out the oil remaining in the model. (Gabriel-USGS)
W69-09502

TRANSIENT STRESSES AND DISPLACEMENT AROUND A WELLBORE DUE TO FLUID FLOW IN TRANSVERSELY ISOTROPIC, POROUS MEDIA: 1. INFINITE RESERVOIRS,
Texas Univ., Austin.
M. S. Seth, and K. E. Gray.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 63-78, 1968. 16 p, 11 fig, 1 tab, 25 ref.

Descriptors: *Stress analysis, *Porous media, *Fluid mechanics, *Water wells, *Groundwater movement, Mathematical studies, Aquifers, Thermal stress, Digital computers, Rocks, Physical properties, Rock properties, Strain, Boreholes, Flow rates, Pressure.
Identifiers: Fluid flow in porous media.

Equations of elasticity for transversely isotropic, axisymmetric, homogeneous, porous media with pore fluid pressure were developed by using an analogy between thermal and porous body stresses. Stress gradients are high near the borehole and die out away from the borehole. Anistropy considerably modifies the states of stress and strain. Radial stresses are compressive or neutral, whereas tangential stresses are tensile, neutral, or compressive, depending upon boundary conditions. In an unbounded system, the vertical stress is essentially proportional to the constant rate of fluid injection at the borehole and decreases with time, whereas the radial and tangential stresses increase with time. At a given location, the radial displacement gradient is dependent upon time. (Gabriel-USGS)
W69-09503

THRESHOLD PRESSURE PHENOMENA IN POROUS MEDIA,
Phillips Petroleum Co., Bartlesville, Okla.; and Michigan Univ., Ann Arbor.
L. K. Thomas.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 174-184, 1968. 11 p, 11 fig, 4 tab, 18 ref, append.

Descriptors: *Pressure, *Saturation, *Porous media, *Pressure measuring instruments, *Mathematical studies, Analytical techniques, Water, Gases, Permeability, Porosity, Surface tension, Water pressure, Aerial photography.
Identifiers: Underground gas storage, Threshold pressure, Bubbling pressure.

Threshold displacement pressures are needed to determine how much overpressure can be used in storing natural gas. An experimental technique for determining threshold pressures by displacing water with gas from samples saturated with water is presented. Threshold pressures for eight low permeability samples were measured. Threshold pressure data obtained in this work, plus data on higher permeability samples reported in the literature, are correlated with porosity, permeability, surface tension and formation resistivity factor. Mercury injection pressures also were measured and correlated with air-water threshold pressures. Threshold pressures were found to be independent of time. An aerial photograph of gas emerging from the top of a core shortly after its threshold pressure has been exceeded shows that the gas bubbles are uniformly distributed across the face of the core. Channeling will occur, however, when an increased gas phase permeability is reached. (Gabriel-USGS)
W69-09504

INVESTIGATIONS OF SURFACE AND GROUNDWATER RUNOFF (RUSSIAN),
For primary bibliographic entry see Field 02E.
W69-09511

METHODS FOR THE EVALUATION OF TOTAL WATER INFLOW INTO DEEP MINES (RUSSIAN),
Kharkov State Univ. (USSR).
G. G. Malevannyy.
Kharkov Univ, Vestnik Geol i Geogr, Ser No 25, No 2, p 66-68, 1967. 3 p, 1 fig, 2 tab.

Descriptors: *Aquifers, *Mathematical studies, *Inflow, Water sources, Water supply, Mineral industry, Coal mines, Hydrologic properties, Water circulation, Fissures (Geology), Shafts (Excavations).
Identifiers: *USSR, Coal mining inflow.

Inflows into Russian coal mines were investigated by assuming a mean coefficient of water supply for

a mean shaft depth and evaluating from the experimental data the coefficient of water supply for each coal horizon. In evaluating the total inflows, the coefficients of water supply were multiplied by the mean productivity of a coal mine. The total inflows were projected for a few coal mines for the years of 1970 and 1980. (Gabriel-USGS)
W69-09512

SOME CHARACTERISTICS OF HYDROLOGICAL STRUCTURES IN NEW OCCURRENCES OF CARBONACEOUS MINERAL SPRINGS IN THE NORTHERN CAUCASUS (RUSSIAN),
Kharkov State Univ. (USSR).
G. F. Kovalevskiy.
Kharkov Univ, Vestnik Geol i Geogr, Ser No 25, No 2, p 69-74, 1967. 6 p, 7 ref.

Descriptors: *Mineral water, *Spring waters, *Hydrologic properties, *Structures, Carbon dioxide, Geology, Sedimentary rocks, Igneous rocks, River basins, Boreholes, Water levels, Piezometry, Water analysis, Discharge measurement, Sulfates, Sodium, Calcium, Temperature, Fissures (Geology).
Identifiers: *USSR, *Northern caucasus, Carbonaceous mineral springs.

The article describes the hydrologic structure and chemical composition of mineral waters of the North Caucasus springs on the basis of boreholes and field geology data. The study shows that the new occurrences of mineral waters in the Kuma and Podkumok River basins are associated with the Jurassic rocks. The formation and distribution of these carbonaceous mineral waters are associated with the tectonic disturbances and the carbonaceous gas is of deep thermometric origin. The study also shows that the direction of the circulation of these carbonaceous mineral waters obeys the law of circulation of groundwaters in sedimentary rocks. (Gabriel-USGS)
W69-09513

GROUNDWATER AND VEGETATION IN TWO PEAT BOGS IN NORTHERN MINNESOTA,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
Roger R. Bay.
Ecology, Vol 48, No 2, p 308-310, Spring, 1967. 3 p, 1 tab, 9 ref.

Descriptors: *Bogs, *Swamps, *Groundwater, *Vegetation, Aquifers, Hydrogeology, Water table, Perched water, Peat, Organic soils, Potholes, Forests, Marsh management, Water quality, Marsh plants, Acidity, Conductivity, Minnesota.
Identifiers: *Peatlands, *Groundwater bogs, *Perched bogs, Bog floristics, Specific conductivity.

Plant cover and water quality of bog waters were related to the surrounding groundwater flow systems in two experimental bogs in northern Minnesota. One bog was considered a perched bog because it was perched above and isolated from the regional groundwater system. The other bog, termed a groundwater bog, was being recharged by the regional flow system. Water in the perched bog ranged from a pH of 4.2 to 4.7, while in the groundwater bog pH ranged from 5.9 to 6.7. Conductivity (micromhos) was also considerably less in the perched bog, varying from 16 to 46, while specific conductivity in the groundwater bog ranged from 44 to 133. Because of the mineral-influenced bog waters, the groundwater bog had a much greater variety and abundance of plant cover, quite typical of the more fertile bog sites. This richness of vegetation was not found in any other perched bog.
W69-09569

HYDROGEOLOGICAL EQUATIONS FOR DETERMINING GROUNDWATER YIELDS IN THE DRAINAGE OF OPENCAST MINES AND LARGE BUILDING PITS (GERMAN),
Lothar Richter.
Z Angew Geol, Vol 14, No 9, p 465-470, Sept 1968. 6 p, 4 fig, 9 tab, 4 ref.

Descriptors: *Mathematical studies, *Groundwater, *Water yield, *Drainage engineering, *Mine drainage, Construction, Water level fluctuations, Hydrologic properties, Water resources, Filtration, Hydrogeology.
Identifiers: Groundwater yield equations.

This article gives a review of the equations pertaining to the water-level fluctuations and yields of aquifers with a free water surface. These equations can be applied for the calculation of hydrologic parameters present in executing large drainage works in general or in drainage of opencast mines. Considering the groundwater resources, both the settled and unsettled lowering processes can be determined by using these equations for the conditions of three-lowering-stage yields. (Gabriel-USGS)
W69-09648

AQUIFER BEHAVIOR WITH INJECTION,
Petrobras Co., and Texas A and M Univ., College Station.
For primary bibliographic entry see Field 04B.
W69-09650

TRANSIENT FUNCTIONS FOR LAND DRAINAGE,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
S. A. Jenab, A. A. Bishop, and Dean F. Peterson, Jr.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR3, Pap 6768, p 361-373, Sept 1969. 13 p, 9 fig, 3 tab, 8 ref, append.

Descriptors: *Drainage, *Runoff, *Infiltration, *Overland flow, *Mathematical studies, Drainage effects, Drainage engineering, Drawdown, Diffusion, Transmissivity, Water storage, Recession curves, Discharge (Water).
Identifiers: Land Drainage.

Solution of the diffusion equation for a line sink in a plane yields the error function. By superposition and integration, functions which describe the transient position and rate of fall of a water table under artificial drainage are developed for multiple drains. These may be used to determine in situ values of transmissivity and storage as well as for discharge. A means of using the method for any initial water table position is presented and some design examples are given. (Knapp-USGS)
W69-09654

WELL CAPACITY FOR CONTINUOUS PERMEABILITY VARIATION,
Northwestern Univ., Evanston, Ill., Technological Inst.; and Soil Testing Espanola, Madrid.
For primary bibliographic entry see Field 08B.
W69-09656

QUICK-RETURN SUBSURFACE FLOW,
Agricultural Res Service, Beltsville, Md. Hydrograph Lab.; and Agricultural Research Service, Madison, Wis. Soil and Water Conservation Div.
For primary bibliographic entry see Field 02G.
W69-09665

GROUNDWATER FLOW IN THE NETHERLANDS DELTA AREA AND ITS INFLUENCE ON THE SALT BALANCE OF THE FUTURE LAKE ZEELAND,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02L.
W69-09666

AN INTERFACE PROBLEM WITH A SOURCE AND A SINK IN THE HEAVY FLUID,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 02L.
W69-09668

GROUNDWATER OCCURRENCE IN THE GOLDENDALE AREA, KLICKITAT COUNTY, WASHINGTON,
Geological Survey, Washington, D.C.
J. E. Luzier.
Geol Surv Hydrol Invest Atlas HA-313, 1 sheet, 1969. 8 fig, 1 map, 1 tab, 9 ref.

Descriptors: *Water resources, *Groundwater, *Washington, Water wells, Water quality, Water yield, Aquifers, Water levels, Hydrogeology, Columbia River, Irrigation water, Municipal water, Water supply.
Identifiers: Klickitat County (Wash).

Groundwater occurrence in the Goldendale area of Klickitat County, Washington is shown by a 1-sheet hydrological atlas consisting of a geohydrologic map scaled 1:6250, drillers logs of representative wells, water level graphs, a precipitation map, and hydrographs of springs and creeks. Selected well records and chemical analyses are tabulated. Most groundwater in the area occurs in permeable basalts. Most groundwater use is for domestic and stock purposes. Springs are the chief sources of public supply, and surface waters are used for irrigation. (Knapp-USGS)
W69-09685

RECONNAISSANCE OF THE GROUNDWATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN KANSAS CITY, MISSOURI AND THE IOWA BORDER,
Geological Survey, Washington, D.C.
L. F. Emmett, and H. G. Jeffery.
Geol Surv Hydrol Invest Atlas HA-336, 1 sheet, 1969. Text, 8 fig, 2 map, 3 tab, 18 ref.

Descriptors: *Water resources, *Missouri, *Nebraska, *Groundwater, Aquifers, Alluvium, Missouri River, Water quality, Water wells, Hydrogeology, Hydrologic data, Water levels, Permeability, Transmissivity.
Identifiers: Kansas City (Mo).

The groundwater resources of the Missouri River alluvium between Kansas City and the Iowa border are described in a 1-sheet hydrological atlas showing the thickness, area, and lithology of the alluvium. Information is given on the occurrence, availability, use, and chemical quality of the groundwater. (Knapp-USGS)
W69-09686

GROUNDWATER APPRAISAL OF THE LITTLE WABASH BASIN ABOVE THE GAGE BELOW CLAY CITY AND THE LOUISVILLE RESERVOIR SITE, ILLINOIS,
Geological Survey, Washington, D.C.
Frank A. Watkins, Jr., and Dale J. Nyman.
US 90th Congr, 2nd Sess, Senate Doc No 96, Vol 2, Append J, p 252-263, 1968. 12 p, 4 fig, 1 tab.

Descriptors: *Water resources development, *Illinois, Groundwater, Surface waters, Water quality, Streamflow, Water pollution, Dams, Reservoirs, Aquifers, Glacial drift, Water levels, Water storage, Hydrologic data, Data collections.
Identifiers: Wabash River Basin.

Moderate to large supplies of groundwater are available from sand and gravel deposits in some areas of the Little Wabash River basin, Illinois and are possible in other areas if the deposits are thick and areally extensive. Deoxygenation is a problem in the streams, during low-flow periods, from above the damsite downstream to at least the gage below Clay City. At the gage below Clay City the total dissolved solids are at times greater than 500 ppm due to high sulfates or high chlorides or both. A dam at the Louisville site would help both these conditions. (Knapp-USGS)
W69-09693

GROUNDWATER APPRAISAL OF THE SKILLET FORK BASIN ABOVE WAYNE CITY AND HELM RESERVOIR SITE, ILLINOIS,
Geological Survey, Washington, D.C.
Frank A. Watkins, Jr.
US 90th Congr, 2nd Sess, Senate Doc No 96, Vol 2, Append J, p 266-275, 1968. 10 p, 4 fig, 1 tab.

Descriptors: *Water resources development, *Illinois, Groundwater, Surface waters, Water quality, Streamflow, Water pollution, Dams, Reservoirs, Aquifers, Water levels, Water storage, Hydrologic data, Data collections.
Identifiers: Wayne City (Ill), Wabash River basin.

Moderate to large supplies of groundwater are not available in the Skillet Fork Basin above Wayne City, Illinois because of the lack of natural subsurface storage and permeable aquifers. The only means of obtaining water supplies with a sustained yield greater than 1.16 cfs, which represents the streamflow exceeded 90% of the time, is the construction of a reservoir in the basin to store water and improve its quality. (Knapp-USGS)
W69-09694

GROUNDWATER APPRAISAL OF THE BIG WALNUT CREEK BASIN ABOVE LITTLE WALNUT CREEK AND BIG WALNUT CREEK RESERVOIR SITE, INDIANA,
Geological Survey, Washington, D.C.
Frank A. Watkins, Jr.
US 90th Congr, 2nd Sess, Senate Doc 96, Vol 2, Append J, p 278-288, 1968. 11 p, 4 fig, 1 tab.

Descriptors: *Water resources development, *Indiana, Groundwater, Surface waters, Water quality, Streamflow, Dams, Reservoirs, Water loss, Aquifers, Water levels, Water storage, Reservoir leakage, Hydrologic data, Data collections.
Identifiers: Wabash River Basin.

Loss of water from a proposed reservoir is possible where the channel of Big Walnut Creek, Indiana is cut into bedrock in the pool area. During dry-weather periods the Creek loses water in this reach. Water supply is not a problem in the basin at the present time but could become a problem in the Greencastle area in a period of severe drought. (Knapp-USGS)
W69-09695

GROUNDWATER APPRAISAL OF THE BIG BLUE RIVER BASIN AND BIG BLUE RESERVOIR SITE, INDIANA,
Geological Survey, Washington, D.C.
Dale J. Nyman, and Frank A. Watkins, Jr.
US 90th Congr, 2nd Sess, Senate Doc No 96, Vol 2, Append J, p 290-301, 1968. 12 p, 4 fig, 1 tab.

Descriptors: *Water resources development, *Indiana, Groundwater, Surface waters, Streamflow, Water quality, Dams, Reservoirs, Aquifers, Glacial drift, Alluvium, Water levels, Water storage, Hydrologic data, Data collections.
Identifiers: Wabash River Basin.

The Big Blue River basin, Indiana has an average dry-weather yield of 0.27 cfs, one of the highest yields of any river in the Wabash River basin. The river gains water for the entire distance from its origin to its mouth near Edinburg; along the upper and lowermost reaches of the main stem the discharge often doubles between measuring sites. The smallest gain in discharge occurs in the reach through the reservoir site. This small gain probably represents a reduction in groundwater discharge due to the relatively small volume of the alluvial aquifer and the low permeability of the adjacent till. Also there may be a minor amount of infiltration to buried valleys underlying the middle and upper portions of the reservoir site. There is no bedrock exposed in or adjacent to the proposed reservoir. Water supply is not a problem in most of the basin at the present time. The water use is for farm, domestic, and small municipal and industrial supplies. Adequate supplies for these purposes are available almost anywhere in the basin from groundwater. (Knapp-USGS)
W69-09696

GROUNDWATER APPRAISAL OF THE FLATROCK RIVER BASIN AND DOWNEYVILLE RESERVOIR SITE, INDIANA,
Geological Survey, Washington, D.C.
Dale J. Nyman, and Frank A. Watkins, Jr.
US 90th Congr, 2nd Sess, Senate Doc No 96, Vol 2, Append J, p 304-314, 1968. 11 p, 4 fig, 1 tab.

Descriptors: *Water resources development, *Indiana, Groundwater, Surface waters, Water quality, Streamflow, Dams, Reservoirs, Aquifers, Limestones, Water levels, Water yield, Water storage, Reservoir leakage, Water loss, Hydrologic data, Data collections.
Identifiers: Wabash River Basin.

The main stem of the Flatrock River, Indiana gains water for the entire distance from its origin to its mouth at Columbus. The largest gains occurred in the vicinity of the Lewisville partial record station, the reservoir site, and a few miles north of Columbus. Nevertheless, loss of water from a proposed reservoir is possible where the Flatrock River is cut into bedrock in the pool area, and at the damsite where the proposed dam is underlain by a buried bedroek valley. The exposed bedrock in the reservoir area is an irregularly bedded and jointed dolomite which is probably more permeable than the underlying shales and carbonate rocks. Water supply is not a problem in most of the basin at the present time except at the city of Columbus. Water use in the basin is for farm, domestic, small municipal and industrial supplies. Adequate supplies for these purposes are available almost anywhere in the basin from groundwater. (Knapp-USGS)
W69-09697

SP LOG INTERPRETATION IN SHALY SANDS,
Koninklijke-Shell Exploratie en Produktie Laboratorium, Rijswijk (The Netherlands).
L. J. M. Smits.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petroleum Eng, Inc, Vol 243, Part 2, p 123-136, 1968. 14 p, 9 fig, 3 tab, 18 ref.

Descriptors: *Electrical well logging, *Boreholes, *Sands, Rocks, Saline water, Saturation, Mathematical studies, Clays, Porosity, Cation exchange, Permeability, Electrochemistry, Diffusivity, Conductivity, Sodium, Membrane processes.
Identifiers: Spontaneous potential interpretation.

A theoretical equation is developed describing membrane potentials of shaly sands as a function of the cation-exchange capacity per unit pore volume of the rock and saturating water salinity. This equation is based on the same simple physical model as that employed earlier describing the electrical conductivity of shaly sands. Experiments conducted with NaCl solutions showed that the equation is obeyed, except in the case of saturated salt solutions where minor deviations were observed. A possible explanation is given for this discrepancy. As the clay content and the porosity of shales may vary appreciably, shale membrane potentials also vary. It was found that membrane potentials of shales can be calculated accurately with the aid of the same theory. Consequently, changes in membrane potentials can be accounted for by simple measurement of cation-exchange capacities per unit pore volume of both shales and shaly sands. Charts are given to facilitate interpretation of the electrochemical part of the SP in terms of cation-exchange capacities and the salinities of mud filtrate and formation water. (Gabriel-USGS)
W69-09699

WATER RESOURCES OF PULASKI AND SALINE COUNTIES, ARKANSAS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W69-09711

AVAILABILITY OF GROUNDWATER IN TEXAS COUNTY, OKLAHOMA,
Geological Survey, Washington, D.C.
P. R. Wood, and D. L. Hart, Jr.
Geol Surv Hydrol Invest Atlas HA-250, 3 sheets, 1967. 7 fig, 3 map, 1 tab.

Descriptors: *Water resources, *Oklahoma, *Groundwater, Water wells, Water levels, Aquifers, Water yield, Water quality, Irrigation water, Water supply, Hydrogeology, Hydrologic data, Water utilization, Water storage.
Identifiers: *Texas County (Okla).

A hydrologic atlas of 3 sheets shows a real distribution of principal geologic units that control occurrence and availability of groundwater, approximate depth to water, and chemical character of groundwater in Texas County, Oklahoma. Approximate thickness of unconsolidated deposits and saturated material, a generalized geologic section, areas favorable for irrigation development, and areas where groundwater levels measured in 1966 have changed significantly from 1938 are also mapped. Basic information are given on the geologic and hydrologic features that govern the general availability of groundwater. Information contained in the atlas may be useful in an analysis of problems involving irrigation and the development and management of groundwater supplies. (Knapp-USGS)
W69-09715

GROUNDWATER RESOURCES OF INDIA-PRESENT STATUS AND SUGGESTED LINES OF FUTURE INVESTIGATION,
Geological Survey of India.
G. C. Chaterji.
Bull Geol Surv of India, Ser B, No 16, 1967. 60 p, 3 plate, 1 tab, 82 ref.

Descriptors: *Water resources development, *Planning, *Hydrogeology, Hydrologic data, Data collections, Surveys, Water law, Water utilization, Irrigation, Water supply.
Identifiers: *India.

The present status of geohydrologic studies in India is outlined and modern procedures and techniques for effective groundwater assessment, development, utilization, and control are discussed. Possibilities for large-scale groundwater development have been found in parts of Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, and other areas. Additional study is necessary to determine safe yields and effects of withdrawal. Waterlogging is a severe problem in many irrigated areas. Needs for future hydrologic study, water quality, recharge, conjunctive use, legal aspects, the direction of future work, and water agency organization are also discussed. (Knapp-USGS)
W69-09716

GROUNDWATER RESOURCES OF THE BURIED MAHOMET BEDROCK VALLEY,
Illinois State Water Survey, Urbana. Water Supply Div.
Adrian P. Visocky, and Richard J. Schicht.
Ill State Water Survey, Urbana, Report of Investigation 62, 1969. 52 p, 37 fig, 22 tab, 40 ref.

Descriptors: Analog model, *Aquifer characteristics, Aquifer evaluation, *Bedrock valley, Glacial drift, *Groundwater development, Groundwater recharge, Illinois, Leakage, Water wells.

The buried Mahomet Bedrock Valley and its major tributaries cover about 3700 square miles in east-central Illinois, and form a large underdeveloped groundwater resource. The largest source of groundwater consists of Kansan sands and gravels, called the deep aquifer; the Illinoian or middle aquifer is a secondary source. Pumpage was 40.2 mgd in 1965. Major pumping centers are at Champaign-Urbana, Rantoul, Lincoln, Taylorville and Hoopeston; the largest is Champaign-Urbana with pumpage of 13.5 mgd in 1965. Recharge in the

Champaign-Urbana area was computed to be 115,000 gpd/sq mi for the Illinoian aquifer in 1947 and 107,000 gpd/sq mi for the Kansan aquifer during 1953-1965. Total groundwater runoff for the valley is estimated to be about 740 mgd during years of normal precipitation. Existing and/or future pumping centers might capture 445 mgd. An electric analog computer was constructed for the Champaign-Urbana area. Withdrawals with a selected pumping scheme would total 30.3 mgd from existing large capacity wells and 15 mgd from five future wells. This study provides data for planning and development of area groundwater resources,
W69-09738

QUALITY OF SURFACE WATER IN ILLINOIS, 1956-1966,
Illinois State Water Survey, Urbana. Water Supply Div.
For primary bibliographic entry see Field 02E.
W69-09739

2G. Water in Soils

NUMERIC STUDIES OF A COMPOSITE SOIL MOISTURE GROUNDWATER SYSTEM,
Drexel Inst. of Tech., Philadelphia, Pa.
G. M. Hornberger, Irwin Remson, and A. A. Fungaroli.
Water Resources Res, Vol 5, No 4, p 797-802, Aug 1969. 6 p, 5 fig, 1 tab, 7 ref.

Descriptors: *Groundwater movement, *Soil water movement, *Mathematical models, Model studies, Infiltration, Percolation, Water table, Darcy's law, Dupuit-Forchheimer theory.
Identifiers: Soil water-groundwater relations.

A model of transient moisture movement in a composite soil moisture-groundwater system is described. The model was used to study two-dimensional flow in response to a falling water table. The solution provided information about the interaction of the saturated and unsaturated portions of the subsurface system. The results of the composite model are compared with those obtained from three one-dimensional groundwater models. That soil moisture and nonlinearity do not have a significant effect on the position of the water table in the system studied is inferred. (Knapp-USGS)
W69-09462

INFLUENCE OF PINYON-JUNIPER CONVERSIONS AND WATER QUALITY ON PERMEABILITY OF SURFACE SOILS,
Utah State Univ., Logan; and Forest Service (USDA), Logan, Utah. Forestry Science Lab.
Gerald F. Gifford, and Ronald K. Tew.
Water Resources Res, Vol 5, No 4, p 895-899, Aug 1969. 5 p, 1 fig, 4 tab, 4 ref.

Descriptors: *Watershed management, *Rainfall-runoff relationships, *Clear-cutting, *Infiltration, *Permeability, Surface runoff, Arid lands, Water management (Applied), Pinyon pine trees, Juniper trees, Water quality, Percolation, Regression analysis, Evapotranspiration.
Identifiers: *Watershed clearing.

Chaining with windrowing treatment in the pinyon-juniper vegetation type significantly increased permeability of surface soils from the 0-2 and 2-4 inch depths at a site in southwestern Utah. Double chaining with debris in place did not yield a significant increase in permeability. Permeability of surface soils from a pinyon-juniper site in southeastern Utah provided a similar trend, though significant differences among treatments were not evident. Water quality influenced percolation only after approximately 30 minutes. Multiple regression equations developed for predicting intrinsic permeabilities varied according to water quality. (Knapp-USGS)
W69-09472

STEADY GRAVITATIONAL CONVECTION INDUCED BY A LINE SOURCE OF SALT IN A SOIL,
Agricultural Research Service, Madison, Wis.
P. A. C. Raats.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 483-487, July-Aug 1969. 5 p, 5 fig, 11 ref.

Descriptors: *Convection, *Diffusion, *Aqueous solutions, *Salts, Solutes, Saturated flow, Unsaturated flow, Soil water movement, Groundwater movement, Mass transfer, Ion transport, Hydraulic conductivity, Soil texture.
Identifiers: Salt solution convection.

A theoretical analysis of steady gravitational convection from a line source of salt in a saturated or in a uniformly partially saturated soil is presented. The flow pattern of the water-solute mixture and the distribution of the salt are shown to depend upon the source strength of the line source, the effective mass diffusion coefficient of the salt in the soil, the hydraulic conductivity of the soil, and a parameter describing the increase in density due to the added solute. Qualitatively, the analysis agrees with experimental observations. Theory and experiment both indicate that gravitational convection can be significant only if the hydraulic conductivity is large, which may be the case if the soil is coarse textured and the water content is not too small. (Knapp-USGS)
W69-09475

SOIL-WATER MOVEMENT IN RESPONSE TO IMPOSED TEMPERATURE GRADIENTS,
California Univ., Davis. Dept. of Water Science and Engineering.
D. K. Cassel, D. R. Nielsen, and J. W. Biggar.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 493-500, July-Aug 1969. 8 p, 10 fig, 4 tab, 21 ref, 1 append. Grant No DAAB G29-07-67-C00034.

Descriptors: *Soil water movement, *Convection, *Water temperature, *Thermodynamic behavior, *Diffusion, Mass transfer, Diffusivity, Water vapor, Thermodynamics, Unsaturated flow.
Identifiers: Temperature gradient, Ficks law.

Redistribution of soil water within insulated, uniformly packed, horizontal samples of unsaturated Columbia fine sandy loam at several soil-water contents was studied in response to imposed temperature gradients ranging from 0.5 to 1.0C/cm. Soil bulk density and initial, transient, and final soil-water-content distributions were determined each 0.5-cm along the column by gamma-radiation attenuation. Initial, transient and final soil temperature distributions were monitored by glass-encased thermistors at 2-cm intervals-both at the center and 0.3 cm from the column wall. Apparent thermal and isothermal soil-water diffusivity values were calculated using transient water content data. The observed net water flux was found to increase with decreasing water content. For Columbia soil the observed mean net water flux across 1-cm sections of the soil showed acceptable agreement with that predicted by the theory of Philip and deVries; Fick's law and the modified Taylor-Cary irreversible thermodynamic equation both underpredicted the observed fluxes. (Knapp-USGS)
W69-09476

WATER MOVEMENT AND FREEZING PRESSURES,
Army Terrestrial Sciences Center, Hanover, N.H. Earth Sciences Branch.
Pieter Hoekstra.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 512-518, July-Aug 1969. 7 p, 12 fig, 1 tab, 14 ref.

Descriptors: *Soil water movement, *Saturated flow, *Freezing, *Frost action, Frost, Ice, Thermodynamic behavior, Laboratory tests, Thawing, Mass transfer.
Identifiers: Ice lenses (Soil), Soil freezing.

Pressures develop when cylindrical columns of saturated soils are frozen unidirectionally under conditions of constant volume with an open water supply at the warm side. The value and behavior of these pressures depend on soil type. If water migration can take place in the frozen soil and ice lenses grow behind the freezing front the value of the pressure depends on the temperature at the ice lens. This process occurs in clayey soils, and the pressure is theoretically limited by the phase transition ice - water. Values of 100 atm have been measured experimentally. In soils where water migration in the frozen soil does not occur and ice lenses form at the freezing front, the pressure reaches a constant value, which may vary between 0.2 atm for a sand soil and 3 atm for a silt soil. Thermodynamic models proposed to explain these phenomena are discussed. (Knapp-USGS)
W69-09480

ON THE INTERACTION OF WATER MOLECULES AND MONTMORILLONITE SURFACES,
Adelaide Univ. (Australia). Dept. of Agricultural Biochemistry and Soil Science.
J. W. Kijne.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 539-543, July-Aug 1969. 5 p, 2 fig, 2 tab, 31 ref.

Descriptors: *Water chemistry, *Adsorption, *Clays, *Montmorillonite, *Ion exchange, Vapor pressure, Thermodynamics, Thermodynamic behavior, Hydration, Entropy.
Identifiers: Heats of wetting.

The adsorption of water was studied on monoionic montmorillonite saturated with Cs, Rb, Li, Na, ammonium, and Ca ions. These ions vary in their influence on the structure of water in solution. Thus the effect on the adsorbed water by exchange ions could be compared with the effect of these ions in solution. Heats of wetting of the montmorillonite samples were determined as a function of the equilibrium relative vapor pressure. Entropy values were calculated from the heats of wetting combined with values of the surface potential from adsorption isotherms using the Gibbs surface excess equation. The decrease in heats of wetting with increasing relative vapor pressure was discontinuous near a relative pressure of 0.1. This was interpreted as indicating a change at the surface of the clay mineral probably related to ion hydration effects. Consequently the obtained entropy changes could not be assigned entirely to the adsorbed water molecules. At low relative vapor pressures the entropy values strongly reflected the influence of the exchange ion which was found to be similar to that exerted by these ions in solution. At higher relative vapor pressures the entropy of the system was about 4 e.u. below that of liquid water which was nearly the same as the likely value for the silicate sheet itself obtained in earlier studies. (Knapp-USGS)
W69-09481

KINETICS OF THE FORMATION AND BREAKDOWN OF A CA-MONTMORILLONITE TACTOIDS,
Negev Inst. for Arid Zone Research, Beersheba (Israel). Dept. of Mechanics of Soil and Materials.
For primary bibliographic entry see Field 02K.
W69-09482

LEACHING OF ADDED SELENIUM FROM ALKALINE SOILS AS INFLUENCED BY SULFATE,
Agricultural Research Service, Kimberly, Idaho. Northwest Branch Soil and Water Conservation Research Div.
M. J. Brown, and D. L. Carter.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 563-565, July-Aug 1969. 3 p, 2 fig, 2 tab, 18 ref.

Descriptors: *Leaching, *Trace elements, *Sulfates, *Soils, Soil water movement, Gypsum, Solubility, Solutes, Aqueous solutions, Water

chemistry, Soil chemistry, Nutrients, Nutrient requirements, Essential nutrients.
Identifiers: Trace nutrients, Barium, Selenium, White muscle disease.

A barium sulfate-selenate mixture (S:Se= 10) and barium selenate alone were applied at 1.60 and 3.20 mg Se per column to two soils and leached with 800 ml of leaching solution added to columns containing 2,100 g of Portneuf silt loam and 2,500 g of Gooding loamy sand at 4-week intervals for 20 weeks. More Se was leached by gypsum solution than by water from all columns. Where 3.20 mg Se per column was applied, more Se was leached by water from Gooding than from Portneuf soil, but the reverse was true with gypsum solution. The Se leached from the Portneuf soil ranged from 0.34 mg, where 1.60 mg Se per column was applied and soils leached with water, to 2.32 mg, where 3.20 mg Se per column was applied and soils leached with gypsum solution. Much less Se was leached where only barium selenate was applied to Portneuf soil. The amount leached ranged from 0.07 mg, where 1.60 mg Se was applied and water used for leaching, to 0.64 mg Se, where 3.20 mg Se was applied and gypsum used for leaching. The Se leached increased with application rate, but not proportionately. It is concluded that addition of sulfate increases the solubility of barium selenate in these soils. (Knapp-USGS)
W69-09483

CONTROL OF POTASSIUM RELEASE AND REVERSION ASSOCIATED WITH CHANGES IN SOIL MOISTURE,
Iowa State Univ. of Science and Technology, Ames. Dept. of Soil Science.
For primary bibliographic entry see Field 02K.
W69-09484

HYDROLOGIC AND MORPHOLOGIC IMPLICATIONS OF ANISOTROPY AND INFILTRATION IN SOIL PROFILE DEVELOPMENT,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering; and Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
Dan Zaslavsky, and A. S. Rogowski.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 594-599, July-Aug 1969. 6 p, 6 fig, 11 ref, append.

Descriptors: *Soil water movement, *Soil profiles, *Anisotropy, *Soil formation, *Infiltration, Percolation, Leaching, Topography, Geomorphology, Soil moisture, Runoff, Soil erosion.
Identifiers: Soil profile development.

The concept of anisotropy as a possible factor of soil formation is introduced and the hydrologic and morphologic implications of water infiltration are demonstrated. It is concluded that the magnitude and direction of downhill flux of infiltrating water will depend on the degree of anisotropy as well as on the land slope and its changes. This conclusion may explain in part the greater differentiation of horizons on flat lands than on sloping lands, and the gradual thinning out of the B horizon uphill as the slope increases. (Knapp-USGS)
W69-09485

POORLY DRAINED SOILS WITH PERMAFROST IN INTERIOR ALASKA,
Army Terrestrial Sciences Center, Hanover, N.H.; and Dartmouth Coll., Hanover, N. H. Dept. of Earth Sciences.
R. J. Allan, Jerry Brown, and Samuel Rieger.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 599-605, July-Aug 1969. 7 p, 3 fig, 2 tab, 25 ref.

Descriptors: *Wetlands, *Permafrost, *Alaska, *Arctic, Freezing, Thawing, Clays, Silts, Sands, Particle size, Soil classifications, Soil formation, Soil investigations, Soil moisture, Soil properties, Soil profiles, Frozen ground, Trace elements.
Identifiers: Gley soils, Histic pergelic cryaquepts.

Physical, chemical, and mineralogical properties are presented for 5 soils with permafrost in interior Alaska. The soils are shallowly thawed, with permafrost usually at 60 cm or less, and with a thick accumulation of organic matter, usually about 25 cm deep, over a gleyed mineral soil. They are classified as Histic Pergelic Cryaquepts in the comprehensive soil classification system adopted by the US Department of Agriculture. Histic Pergelic Cryaquepts are the most extensive soils developed over permafrost in Alaska. In three of the 5 profiles, particle-size analyses reveal a slight increase (2-4%) in clay content of the thawed mineral soil over that of the permafrost. The coarsest horizon in all 5 profiles contains only 48% sand. The dominant texture is silt loam. In one of the profiles, base saturation increases (52%-90%) with depth in the thawed mineral soil, then remains fairly constant in the permafrost. Percent Zr (0.02%) remains constant in the coarse silt fraction of all horizons of all 5 profiles both above and in the permafrost. The dominant clay minerals in the thawed horizons were vermiculite and kaolinite. (Knapp-USGS)
W69-09486

PHYSICAL PROPERTIES OF PEATS AS RELATED TO DEGREE OF DECOMPOSITION,
Forest Service (USDA), Grand Rapids, Minn. Northern Conifers Lab.
D. H. Boelter.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 606-609, July-Aug 1969. 4 p, 4 fig, 3 tab, 6 ref.

Descriptors: *Soil physical properties, *Peat, Soil structure, Soil classifications, Organic matter, Hydraulic conductivity, Permeability, Water yield, Decomposing organic matter.
Identifiers: Peat fiber content.

Important physical characteristics, such as water retention, water yield coefficient, and hydraulic conductivity, vary greatly for representative northern Minnesota peat materials. The differences are related to the degree of decomposition, which largely determines the porosity and pore size distribution. Fiber content and bulk density are properties often measured to indicate the degree of decomposition of peat materials and are criteria used to distinguish fibric, hemic, and sapric peat types. Regression analysis showed a curvilinear relationship of water contents at saturation, 5 mbar, 0.1 bar, and 15 bar suctions, to fiber content and bulk density with coefficients of multiple determination ranging from .66 to 0.88. Regression analysis of the logarithm of hydraulic conductivity on fiber content and bulk density indicate a linear relationship although not as strong, due to the variability of hydraulic conductivity. It is concluded that the classification of peat materials and organic soils based primarily on degree of decomposition as measured by fiber content and bulk density relates significant information about their physical characteristics. (Knapp-USGS)
W69-09487

EVAPORATION FROM A SIMULATED SOIL SHRINKAGE CRACK,
Agricultural Research Service, Temple, Tex. Soil and Water Conservation Research Div.; and Agricultural Research Service, Big Spring, Tex. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02D.
W69-09488

CHEMICAL AND BIOLOGICAL WEATHERING IN VERMICULITE FROM TRANSVAAL,
Yale Univ, New Haven, Conn. School of Forestry.
For primary bibliographic entry see Field 02K.
W69-09489

THE EMF OF PLATINUM ELECTRODES IN DILUTE SOLUTIONS AND ITS RELATION TO SOIL pH,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
For primary bibliographic entry see Field 02K.
W69-09490

REPLACEMENT OF WATER BY AIR IN SOIL PORES,
National Research Council of Canada, Ottawa (Ontario).
P. J. Williams.
Norw Geotech Inst, Publ Nr 72, p 75-90, 1968. 16 p, 12 fig, 12 ref.

Descriptors: Soil engineering, *Soil mechanics, Soil moisture, Soils, Soil properties, Soil tests, *Soil water, *Soil water movement, Moisture content, Capillary action, Capillarity, Capillary water, Pore pressure, Pores, Pore water pressures, Negative poor pressure, Diffusion, *Airwater interfaces.
Identifiers: Soil pore structure, Soil moisture storage, Soil suction, Soil-water interface, Soil-water interaction, Pore structure.

Soils composed of minerals having the same refractive index as water are translucent when saturated. Any air in the pores is fully visible. Such soils have been used to observe how air may replace water in soil pores. Three distinct processes that may occur in a soil when a difference in pressure P is established between the air and water are: (1) A process explained by capillary theory. If this process alone occurs, it gives a curve of moisture content versus P in which there is a conspicuous air-intrusion value of P, corresponding to an interface radius r sub c equal to that of the largest continuous openings through the soil. (2) A process that occurs more slowly, involving diffusion of air (from air external to the sample) to entrapped air bubbles, with a resulting enlargement of these. (3) A process of slow advance of interfaces into the soil, possibly due to a change with time, of interfacial energy, contact angle, or interface radius, or to a process not explained by the capillary theory. Advancement occurs under constant P. Additional drainage may occur because of consolidation caused by stresses on the soil skeleton, arising from the air-water pressure difference. This drainage may occur suddenly with the development of cracks in the soil. (USBR)
W69-09525

FACTORS INFLUENCING SOIL-MOISTURE RELATIONSHIPS IN UNDRAINED FORESTED BOGS,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
Roger R. Bay.
Proceedings, International Symposium on Forest Hydrology, Pergamon Press, oxford, England, p 335-343, 1967. 9 p, 2 tab, 4 fig, 25 ref.

Descriptors: *Bogs, *Swamps, *Soil moisture, *Organic soils, Forest soils, Saturated soils, Water table, Groundwater, Hydrology, Soil physical properties, Peat, Minnesota.
Identifiers: *Peatlands, *Bog hydrology, Peat bogs, Groundwater bogs.

Saturated bogs or peatlands are found in all parts of the world, yet they receive little attention from hydrologists. Studies in northern Minnesota, U.S.A., have shown that a number of factors influence soil-moisture relationships and water storage characteristics in forested bogs. Various peat types were found to have significantly different physical properties which, in turn, directly affect water retention and water movement rates in bogs. Hydrogeologic conditions, particularly the influence of the regional groundwater system or the lack of such influence, directly affect bog water table fluctuations. Other factors such as hydrometeorologic events, vegetation characteristics, and evapotranspiration losses influence the soil-moisture regime. In the study bogs, soil moisture conditions were directly related to, and often described by, the position of the water table in the organic soil profile. The height of the bog water table, in turn, influenced storage capacity and runoff from the entire bog watershed.
W69-09570

HYDROLOGIC CHARACTERISTICS OF ORGANIC SOILS IN LAKE STATES WATERSHEDS,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
Don H. Boelter.
J Soil and Water Conserv, 1966, 21 (2): 49-53. 5 p, 4 fig, 2 tab, 14 ref.

Descriptors: *Hydrologic properties, *Organic soils, *Peat, *Bogs, Watersheds (Basins), Bogs, Saturated soils, Water table fluctuations, Soil physical properties, Water storage, Hydraulic conductivity, Bulk density, Water contents, Storage capacity, Porosity, Minnesota.
Identifiers: *Bog hydrology, Peatlands, Peat types, Degree of decomposition, Pore size distribution, Wetland hydrology.

The physical properties of peats determine to a large degree the role of a given bog in the local and regional water regime. Studies have shown that most bogs are not the good water storage reservoirs they are often thought to be. Certain types of undecomposed moss peats appear to have a large capacity for water storage but actually provide little storage because their large pores release the water so quickly. Decomposed and herbaceous peats, on the other hand, provide little storage capacity because little water is removed from their small pores when the water table is lowered. This paper summarizes some of the hydrologic characteristics of several peat types studied over the past few years and relates these to land productivity and watershed values. Land managers must learn to recognize differences in peat types and understand their role in watershed management to properly manage over 15 million acres of peatlands in the northern Lake States.
W69-09573

HYDRAULIC CONDUCTIVITY OF PEATS,
Forest Service (USDA)Rapids, Minn. North Central Forest Experiment Station.
D. H. Boelter.
Soil Sci, 1965, 100 (4): 227-231. 5 p, 2 tab, 14 ref.

Descriptors: *Hydraulic conductivity, *Peats, *Water movement, *Saturated flow, Soil physical properties, Bulk density, Porosity, Water storage, Organic soils, Bogs, Hydrologic properties, Specific yield, Minnesota.
Identifiers: *Peat types, Pore size distribution, Horizontal hydraulic conductivity, Vertical hydraulic conductivities.

The rate of water movement through and out of a bog area will depend largely on the peat material found in the organic soil profile. In most lake-filled bogs water flows through moss peat horizons near the surface and little flows through dense herbaceous peats at lower horizons. In other types of bogs with different peat profiles, more flow may occur at greater depths. Hydraulic conductivities (or water movement rates) of peat types were found to cover a wide range of values. The values were related to specific yield and to pore-size distribution. Field-measured hydraulic conductivities of peats were significantly lower than corresponding laboratory values, and these field values were accepted as more accurately representing water movement rates of organic soils. Further analysis indicated no significant difference between vertical and horizontal hydraulic conductivity as measured by the tube and piezometer methods.
W69-09574

IMPORTANCE OF VOLUMETRIC EXPRESSION OF WATER CONTENTS OF ORGANIC SOILS,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
D. H. Boelter, and G. R. Blake.
Soil Sci Soc Amer Proc, 1964, 28 (2): 176-178. 3 p, 3 fig, 1 tab, 5 ref.

Descriptors: *Water content, *Bulk density, *Peat, *Organic soils, Soil physical properties, Bogs, Swamps, Soil water, Hydrologic properties, Soil physics, Soil analysis, Saturated soils, Water storage, Minnesota.
Identifiers: *Volumetric water contents, Peatlands, Bog hydrology.

Methods for evaluating water contents and bulk densities of several different peats are compared, Because bulk densities (saturated volume basis) of moss, herbaceous, and aggregated peats varied from 0.028 to 0.249 g. per cc., a highly distorted impression of the amount of water actually held under field conditions is given if water values are expressed on an oven-dry weight basis. On a wet-volume basis, moss peat held only 10 to 20% more water at saturation than did herbaceous and aggregated peat and retained less water than they did at higher suctions. Between 0.1 and 15 bars, moss peat retained about one-quarter the volume of water of a medium-textured mineral soil, Barnes loam. Since considerable volume reduction occurs on drying, bulk density of oven-dry peat, Db (dry volume basis), represents an artificial condition rarely, if ever, occurring in undrained bogs. Bulk densities must, therefore, be calculated on the basis of the wet bulk volume and are referred to as Db (wet bulk volume). A more precise expression of degree of wetness may be substituted for 'wet' in the wet volume basis term.
W69-09575

WATER STORAGE CHARACTERISTICS OF SEVERAL PEATS IN SITU,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
D. H. Boelter.
Soil Sci Soc Amer Proc, 1964, 28 (3): 433-435. 3 p, 3 fig, 2 tab, 5 ref.

Descriptors: *Water storage, *Peats, *Organic soils, *Porosity, *Storage coefficient, Soil physical properties, Bogs, Swamps, Bulk density, Soil water, Hydrologic properties, Available moisture, Moisture tension, Water level fluctuations, Minnesota.
Identifiers: *Water storage capacity, *Pore size distribution, *Peat type, Available water, Water suction.

Water storage characteristics of the various horizons in a northern Minnesota bog were found to vary considerably with peat type. Surface horizons of sphagnum moss peat contain 0.020 g. per cc. of dry material and 95 to nearly 100% water by volume at saturation. Its total porosity consisted primarily of large pores which released 0.80 cc. of water per cc. between saturation and 0.1 bar suction. Decomposed and herbaceous peats from horizons below 25 cm. had water-holding properties strikingly different from those of the moss peats. These materials had bulk densities of 0.24 and 0.14 g. per cc., respectively, and they contained between 80 and 90% water by volume at saturation. Their porosity, though high, consisted primarily of many small pores which are not easily drained at low suctions. They retained 65 to 75% water by volume at 0.1-bar suction. These data show that a specific change in water table elevation in the horizons containing loose, porous, undecomposed moss peat would involve a great deal more water than the same change in horizons of more dense decomposed and herbaceous peats. Thus, the hydrologic role of any bog or bog area in a watershed will depend on the type of peat found in the organic soil profile.
W69-09576

PLANNING AND INTERPRETING SOIL PERMEABILITY MEASUREMENTS,
Agricultural Research Service, Phoenix, Ariz., Water Conservation Lab.
Herman Bouwer.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR3, Pap 6775, p 391-402, Sept 1969. 12 p, 4 fig, 3 tab, 19 ref, append.

Descriptors: *Permeability, *Soil water movement, *Measurement, *Planning, Instrumentation, Drainage engineering, Infiltration, Hydraulic conductivity, Irrigation design.
Identifiers: Soil permeability measurement.

Field techniques for measuring soil hydraulic conductivity (below the water table as well as above, or in the absence of, a water table) are considered. In selecting a technique for a given situation, care should be taken that the soil region and dominant flow direction in the system to be analyzed or predicted are as closely duplicated by the technique as possible. If the soil region covered by an individual measurement is small compared to that of the actual system, measurements at different depths and locations are necessary. The resulting values will seldom if ever be uniform and simplification to manageable media may be required. The average hydraulic conductivity of a randomly heterogeneous medium must lie between the harmonic and the arithmetic mean. Studies with a resistance network analog show that this average hydraulic conductivity is best estimated by the geometric mean. (Knapp-USGS)
W69-09658

QUICK-RETURN SUBSURFACE FLOW,
Agricultural Res Service, Beltsville, Md. Hydrograph Lab.; and Agricultural Research Service, Madison, Wis. Soil and Water Conservation Div.
D. G. Jamieson, and C. R. Amerman.
J Hydrol, Vol 8, No 2, p 122-136, June 1969. 15 p, 1 tab, 16 ref.

Descriptors: *Soil water movement, *Subsurface runoff, *Routing, *Surface-groundwater relationships, Water storage, Model studies, Mathematical models, Simulation analysis, Hydrograph analysis, Systems analysis, Infiltration, Overland flow, Percolation.
Identifiers: Quick-return subsurface flow.

One of the least understood of all hydrologic problems is that of lateral flow in the soil's upper horizons. The nature and quantity involved in this quick-return flow are unknown and have to be inferred from the shape of the observed hydrograph. An attempt has been made to mathematically simulate the flow phenomenon using rainfall as input and a system of interconnected, nonlinear reservoirs as the operator. (Knapp-USGS)
W69-09665

SOIL MOISTURE CONDITION MEASUREMENT AS A STREAMFLOW FORECASTING PARAMETER,
Soil Conservation Service, Boise, Idaho.
Morlan W. Nelson.
J Soil and Water Conserv, Vol 24, No 4, p 147-148, Aug 1969. 2 p, 3 tab.

Descriptors: *Soil moisture, *Snowpacks, *Snow surveys, *Runoff forecasting, Statistical methods, Regression analysis, Streamflow forecasting, Snow management, Snowmelt.
Identifiers: *Boise River (Idaho), Payette River (Idaho), Salmon Falls Creek (Nev).

Soil moisture stations were established on snow courses known to correlate with streamflow in the Western U.S. Readings are taken monthly throughout the winter months and are used to correct snowpack data. Regression analysis results are tabulated for the Boise River near Boise Idaho, Payette River near Horseshoe Bend, Idaho, and Salmon Falls Creek near San Jacinto, Nevada. (Knapp-USGS)
W69-09672

SP LOG INTERPRETATION IN SHALY SANDS,
Koninklijke-Shell Exploratie en Produktie Laboratorium, Rijswijk (The Netherlands).
For primary bibliographic entry see Field 02F.
W69-09699

ROLE OF SOIL MOISUTRE IN THE HYDROLOGICAL CYCLE,
Ontario Agricultural Coll., Guelph. School of Agricultural Engineering.
H. D. Ayers.
Proc Hydrol Symp No 6, Nov 15-16, 1967. Soil Moisture, Nat Res Counc of Canada, p 3-21, 1968. 19 p, 1 fig, 20 ref.

Descriptors: *Soil moisture, *Vadose water, *Hydrologic cycle, *Evapotranspiration, *Water balance, Moisture stress, Snowmelt, Precipitation (Atmospheric), Transmissivity, Retention, Groundwater recharge, Freezing, Watersheds (Basins), Model studies.
Identifiers: *Soil moisture system, Watershed response model.

The soil moisture system is examined and discussed in relation to the role of soil in influencing moisture retention, detention, transmission or rejection of rainfall or snowmelt throughout the watershed. Soil moisture in the water cycle is defined qualitatively. The zone of soil moisture is critical in the hydrological cycle because movements to and from this zone are an integral part of groundwater recharge, evapotranspiration, crop-moisture studies, and of the effects of freezing-thawing cycles. Moisture zone data are essential in the water balance studies in any localized or regional area or stream basin. The author emphasizes integration of soil moisture into the hydrological cycle and concludes with the presentation of a conceptual model of a basin for illustrative purposes. (Lang-USGS)
W69-09705

2H. Lakes

GENERATION OF AN EVAPORATION TIME SERIES FOR LAKE ONTARIO,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 02D.
W69-09461

SUMMARY OF RESERVOIR SEDIMENT DEPOSITION SURVEYS MADE IN THE UNITED STATES THROUGH 1965.
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 02J.
W69-09493

SEDIMENTATION OF RESERVOIRS,
Central Soil Mechanics Research Station, New Delhi (India).
For primary bibliographic entry see Field 02J.
W69-09657

OSCILLAXANTHIN IN THE SEDIMENT OF LAKE WASHINGTON,
Washington Univ., Seattle, Dept. of Zoology.
Mary Griffiths, Pamela S. Perrott, and W. T. Edmondson.
Limnol and Oceanogr, Vol 14, No 3, p 317-326, May 1969. 10 p, 1 fig, 2 tab, 22 ref. Grant GB-4851X (NSF).

Descriptors: *Lakes, *Sediments, Pigments, *Washington, Organic matter, Plankton, Sewage, Productivity, Chemical analysis, Algae, Spectroscopy, Sedimentation rates, Erosion.
Identifiers: Lake Washington sediment.

Oscillaxanthin in Lake Washington sediment was determined quantitatively from cores cut in slices 1 cm thick. The pigment content varies with depth consistently in all cores; however, the amount of pigment per unit dry weight of sediment is highest at the surface and has two subsurface maxima at 4 cm depth and 7 to 9 cm depth. The total accumulated pigment under unit area of bottom mud varies from 27.10 to 6.66 microgram/sq cm. The oscillaxanthin-producing algae evidently were somewhat differently distributed during sedimentation, for the differences are not related to differences in distribution of the plankton. The study indicates that the first appearance of oscillaxanthin probably came early in the period of sewage enrichment that led to the recent diversion of sewage from Lake Washington. (Gabriel-USGS)
W69-09675

THE ANNUAL AND DIURNAL VARIATION IN THE VERTICAL DISTRIBUTION OF ACID-SOLUBLE FERROUS AND TOTAL IRON IN A SMALL DIMICTIC LAKE,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Biology and Health Physics Div.
For primary bibliographic entry see Field 05A.
W69-09677

SOME PHOTOSYNTHETIC CHARACTERISTICS OF A NATURALLY OCCURRING POPULATION OF OSCILLATORIA AGARDHII GOMONT,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
A. L. Baker, A. J. Brook, and A. R. Klemer.
Limnol and Oceanogr, Vol 14, No 3, p 327-333, May 1969. 7 p, 5 fig, 15 ref.

Descriptors: *Algae, *Photosynthesis, *Lakes, *Population, *Minnesota, Productivity, Oxygen, Analytical techniques, Light intensity, Water chemistry, Water temperature, Plankton, Phytoplankton, Nutrients.
Identifiers: Lake Itasca (Minn).

Both absolute and relative values of net photosynthesis were measured directly in a field experiment conducted on August 7, 1967 using an almost monospecific natural population of the blue-green alga Oscillatoria agardhii. Relatively short (2-hr) incubation periods were utilized so that diurnal curves could be established. The net rate of oxygen production varies with light intensity reaching light saturation at near 10% of the maximum insolation. High rates of production occur during twilight at the surface, and the highest production is at 30% of noon intensity. Light quality, as well as intensity, is important, and filtering effect of lake water enhances subsurface oxygen production even at relatively high light intensities. (Gabriel-USGS)
W69-09678

SEASONAL FLUCTUATIONS OF LAKE MICHIGAN DIATOMS,
Bureau of Commercial Fisheries, Ann Arbor, Mich.
Ruth E. Holland.
Limnol and Oceanogr, Vol 14, No 3, p 423-436, May 1969. 14 p, 7 fig, 3 tab, 32 ref.

Descriptors: *Diatoms, *Lake Michigan, *Seasonal, Sampling, Plant populations, Biomass, Analytical techniques, Chemical analysis, Water analysis, Nitrates, Phosphates, Chlorophyll.
Identifiers: Lake Michigan diatoms.

Water samples containing diatoms were collected at 4 areas of Lake Michigan and Green Bay from April to November 1965. The flora of the lake is characterized by 7 diatom species and the Green Bay water is characterized by 6 species, with Stephanodiscus niagarae dominating the biomass of the Bay. There was an average of 517 diatoms per ml in the lake and 944 per ml in Green Bay. Diatom abundance appeared to have 1 peak in the lake and 2 peaks in the bay. The higher population near the eastern shore of the lake and in Green Bay appeared to be correlated with higher concentrations of phosphorous and chlorophyll and lower concentrations of nitrate. (Gabriel-USGS)
W69-09679

CHANGES IN THE WATERS OF THE DANUBE REGION IN THE BLACK SEA AND THE EFFECT ON ANCHOVY BREEDING,
Odessa State Univ. (USSR). Dept. of Hydrobiology.
For primary bibliographic entry see Field 02L.
W69-09702

PHYSICOCHEMICAL LIMNOLOGY AND RELATED FISH DISTRIBUTION OF KEYSTONE RESERVOIR,
Oklahoma State Univ., Stillwater. Aquatic Biology Lab.
Rex L. Eley, Neil E. Carter, and Troy C. Dorris.
Reservoir Fish Resources Symp, Georgia Univ. Apr 5-7, 1967, p 333-357, 1967. 25 p, 21 fig, 8 tab, 20 ref.

Descriptors: *Limnology, *Reservoirs, *Fisheries, *Water quality, *Thermal stratification, Chemical stratification, Density stratification, Hypolimnion, Dissolved oxygen, Water temperature, Conductivity, Alkalinity, Decomposing organic matter, Anaerobic conditions, Carbon dioxide, Turbidity, Light penetration.
Identifiers: *Keystone Reservoir (Ark), *Physicochemical limnology, Vertical fish distribution.

Water temperature, conductivity, pH, alkalinity, carbon dioxide, specific gravity, oxygen, turbidity, and light penetration were determined for each meter of depth at 4 stations along the Cimmaron arm of Keystone Reservoir from September 1965 through August 1966. Occasional measurements were also made at several points on the Arkansas arm and below Keystone Dam. The vertical fish distribution was also determined. Chemical and thermal stratifications due to density differences between Arkansas and Cimarron River waters were present in Keystone Reservoir during all seasons. Relatively high concentrations of carbon dioxide, hydrogen sulfide, and ammonia accumulated in the hypolimnion as a result of organic matter decomposition under anaerobic conditions. However, water quality in the hypolimnion improved as a result of oxygenation during discharge. It was concluded the vertical distribution of fish was highly temperature dependent. Also, oxygen values lower than 2 mg/l was a limiting factor for the fish distribution in Keystone reservoir. (Carstea-USGS)
W69-09708

THE ENVIRONMENT AND PLANKTON DENSITY IN MISSOURI RIVER RESERVOIRS,
Bureau of Sport Fisheries and Wildlife, Yankton, S. Dak.
N. G. Benson, and B. C. Cowell.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, p 358-373, 1967. 6 p, 6 fig, 3 tab, 19 ref.

Descriptors: *Reservoirs, *Productivity, *Plankton, *Water quality, *Missouri River, Zooplankton, Phytoplankton, Density currents, Turbidity, Water temperature, Ions, Diatoms, Chemical stratification, Copepods.
Identifiers: *Missouri River reservoirs, Plankton density.

Morphometry, water chemistry, temperature, currents, turbidity, and phytoplankton were studied in the 6 main reservoirs on the Missouri River, which have a total area of 463,000 ha. Each reservoir is covered yearly by ice from 85 to 123 days. Heavy winds and currents prevent stratification in the upper 12 m of water of the large reservoirs. Generally, density currents are not common in the reservoirs. Turbidity is caused by fine sand, silt and clay particles. Calcium, magnesium, bicarbonates, and sulfates occur in relatively high concentrations. Chemical stratification was found in Garrison Reservoir. Diatoms dominate the flora; the maximum densities of phytoplankton occurred in spring and early summer, as well as in late summer and fall. Among zooplankton, Cladocera and Copepoda showed little vertical or horizontal stratification in Lewis and Clark Lake. Protected areas in Oahe Reservoir have higher zooplankton densities than unprotected areas. Turbidity is the strongest limiting factor for plankton development in the reservoirs. The dynamics of the plankton in a reservoir can be understood only in the amounts of inflowing, indigenous and discharging plankton are known. (Carstea-USGS)
W69-09709

PHYSICOCHEMICAL LIMNOLOGY OF FOUR RESERVOIRS IN SOUTHWEST NEBRASKA,
Bureau of Sport Fisheries and Wildlife, Billings, Mont.; and Nebraska Game, Forestation, and Parks Commission, Lincoln.
Donald L. Tennant, Robert E. Thomas, and Joe Gray.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, p 537-540, 1967. 4 p.

Descriptors: *Limnology, *Reservoir fisheries, *Thermocline, *Nebraska, *Water quality, Water temperature, Dissolved oxygen, Reservoirs, Stratification, Outlets, Physical properties, Chemical properties.
Identifiers: *Reservoir limnology, Nebraska reservoirs.

Physicochemical data from 4 reservoirs in Nebraska taken within a 30-hr period in August, revealed moderate thermal stratification, closely associated in 2 reservoirs with the functioning low-level outlet. The reservoirs with thermoclines exhibited greater temperature ranges and contained cooler waters than did reservoirs without thermoclines. The distribution of fish as detected on sonar often revealed the presence and location of a thermocline prior to physical or chemical data verification. Without exception, the larger the reservoir and the lower the outlet, the better the reservoir fishery. Downstream fisheries ranked the same with one exception. (Carstea-USGS)
W69-09712

EUTROPHICATION FACTORS IN NORTH CENTRAL FLORIDA LAKES,
Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
For primary bibliographic entry see Field 05C.
W69-09723

USE OF LIGHT NUCLIDES IN LIMNOLOGY,
Yale Univ., New Haven, Conn. Geochronometric Lab.; and Yale Univ., New Haven, Conn. Dept. of Geology.
For primary bibliographic entry see Field 05C.
W69-09745

THE PRESENT STATE OF LAKE ZURICH (IN GERMAN),
Kantonales Laboratorium, Zurich (Switzerland). Limnologische Abteilung.
E. A. Thomas, and E. Marki.
Proc of the International Association of Theoretical and Applied Limnology, Vol 10, p 476-488, 1949. 9 fig.

Descriptors: *Eutrophication, *Lakes, Limnology, Hydrogen ion concentration, Cycling nutrients, Phytoplankton, Temperature, Nitrates, Ammonia, Phosphorus, Manganese, Chlorides, Sulfates.
Identifiers: Lake Zurich (Switzerland), Switzerland, Oscillatoria rubescens, Oxidation capacity, Solid matter.

The first part of the paper by Thomas reports, largely in graphic form, monthly or occasional changes in nutrient content (nitrate, ammonia, phosphorus, manganese) temperature, and density of plankton, particularly that of Oscillatoria rubescens, in Lake Zurich. Observations cover a period from October 1943 to December 1947, and from surface to 140 meter depths. The second part of the report, by Marki, gives account of changes that took place during the same period in the contents of oxygen, calcium carbonate, carbon dioxide, pH value, chloride and sulphate ions, oxidation capacity, and solid matter on air-dry and oven-dry basis. (Wilde-Wis)
W69-09746

THE IONIC COMPOSITION OF LAKE WATERS,
Uppsala Univ. (Sweden). Inst. of Limnology.
Wilhelm Rodhe.
Proc of the International Association of Theoretical and Applied Limnology, Vol 10, p 377-386, 1949. 21 fig, 2 tab, 4 ref.

Descriptors: *Ions, *Lakes, *Water chemistry, Limnology, Electrolytes, Statistics, Water analysis, Colloids, Geochemistry, Conductivity.
Identifiers: Seawater minerals, Freshwater minerals, Bicarbonate water types, Standard water composition, Conductivity of lake waters.

The author subjected to statistical treatment 5,300 analytical values on Swedish lakes, given in the voluminous monograph of G Lohammar's 'Wasserchemie und Hohere Vegetation Schwedischer Seen' (1938). Examination of recalculated data revealed a surprisingly close coincidence of the average composition of Swedish lakes with that of freshwaters (lakes and rivers) of the world, as given by F W Clarke in his 'Data of Geochemistry' (1911). The author attributes this coincidence to ionic exchanges between free ions and the colloidal systems of soils and lake muds. He concludes that there is no need for a complete water analysis of bicarbonate lakes having the same content of electrolytes, as expressed by the conductivity of the water and the concentration of the major constituents (calcium, magnesium, sodium, potassium, chloride, sulfate, and bicarbonate ions). (Wilde-Wis)
W69-09747

SEDIMENTATION IN ARTIFICIAL LAKES,
Soil Conservation Service, Washington, D.C.
Stafford C. Happ.
A Symposium on Hydrobiology, p 35-44, 1941. Wisconsin Univ Press, Madison. 2 tab.

Descriptors: *Lakes, *Sedimentation, Floods, Erosion, Chaparral, Grazing, California.
Identifiers: Deforestation, Erosion intensity, Lake capacity, Los Angeles (Calif).

Detailed surveys by the U S Soil Conservation Service and other agencies, of 148 artificial lakes showed the following average annual loss of the water-retaining volume of artificial lakes due to sedimentation of erosion products: 34 lakes, less than 0.5%; 39 lakes, 0.5 to 1%; 39 lakes, 1 to 2%; 36 lakes, over 2%. The latter figure includes 11 lakes in the Los Angeles, California, area surveyed after the catastrophic flood of 1938. For an appraisal of the erosion intensity, accumulation of sediment per unit of drainage area (in cubic feet per acre) is more significant than the reduction in the capacity of lakes. Cultivation of soils, overgrazing, deforestation, and burning off the chaparral or brush are the major causes of excessive sedimentation. (Wilde-Wis)
W69-09748

INCREASE IN THE CONTENT OF ORTHO-PHOSPHORUS AS AN EXPRESSION OF PROGRESSIVE EUTROPHICATION OF LAKE CONSTANCE (GERMAN),
Institut fur Seenforschung und Seenbewirtschaftung Langenargen am Bodensee.
Richard Kliffmuller.
Int Revue ges Hydrobiologie, Vol 47, No 1, p 118-122, 1962. 1 fig, 1 tab, 12 ref.

Descriptors: *Phosphorus compounds, *Eutrophication, Oligotrophy, Lakes, Water analysis, Limnology, Nutrients, Cycling nutrients, Turnovers, Thermal stratification.
Identifiers: *Lake Constance (Switzerland), Switzerland, Germany.

The change which Lake Constance has undergone from the oligotrophic state to a moderately eutrophic condition is expressed by a rather sharp curve for the water content of ortho-phosphorus. In 1958-1959, the curve attained its peak at approximately 9 milligrams/cubic meter of ortho-phosphorus. The author stresses the importance of confining water analyses to the end of turnover, i.e., months of March or April, depending on weather conditions of the year. (Wilde-Wis)
W69-09752

CHEMICAL INVESTIGATION OF LAKE SEDIMENTS AND THEIR INTERPRETATION,
Freshwater Biological Association, Windermere (England).
F. J. H. Mackereth.
Proc Royal Society, B, Vol 161, p 295-309, 1965. 14 fig, 4 ref.

Descriptors: *Chemical properties, *Lakes, *Sediments, Carbon cycle, Clay, Erosion, Climate, Leaching, Deforestation, Halogens, Peat, Pollens, Connecticut, Chlorine.
Identifiers: English Lake District, Linsley Pond (Conn), Chemical stratigraphy, Elemental rations, Bromine, Altitudinal effects.

The content of organic carbon is considered as the most important variable of lake sediments. The composition of sediments is attributed to geological features and the history of watersheds, rather than the composition of lake basins. To some extent, sediments reflect the stability of land surfaces. The sediment content of potassium and sodium may serve as a gauge of the intensity of post-glacial erosion. The presence of calcium suggests incidence of severe denudations. The sequence of changes in lake sediments is influenced by variation in climatic conditions, impoverishment of soils by leaching and deforestation. Climatic conditions of the past were appraised on the basis of the content of halogens (chlorine, bromine) transported from the ocean and indicating oceanity of climate. (Wilde-Wis)
W69-09754

CONTROL OF SEDIMENTATION AND BOTTOM CONFIGURATION BY CONVECTION CURRENTS, LAKE WASHINGTON, WASHINGTON,
Humble Oil and Refining Co., Houston, Tex.; and Coast Guard, Woods Hole, Mass.
Howard R. Gould, and Thomas F. Budinger.
Journal of Marine Research, Vol 17, p 183-198, 1958. 6 fig, 10 ref.

Descriptors: *Sedimentation, *Convection, *Currents (Water), Glacial drift, Glaciation, Mud, Temperature, Circulation, Radioactive dating, Sediments, Washington, Clay, Lakes, Limnology.
Identifiers: *Bottom configuration, *Lake Washington (Wash), Seattle (Wash), Lake topography, Physical limnology.

Lake Washington, in Seattle's environs, occupies a deep, narrow W-shaped trough in cross section, sculptured by the last continental glacier. The sediments consist of blue clay of meltwater origin, more than 100 feet thick, overlain by limnic gyttja 5 to 55 feet thick. Core profiles across the lake show that the trough was U-shaped at the close of the blue-clay deposition and that the W-shaped profile had its present configuration for approximately 6,700 years. Sedimentation rates differed appreciably even over short distances over the lake bottom. Investigations of lake temperature profiles, together with model experiments to simulate conditions of convective flow, point to convection currents as responsible for the observed variations in sedimentation of gyttja which, in turn, account for the unusual W-shaped configuration of the trough floor. (Bortleson-Wis)
W69-09757

THE STUDY OF LAKE DEPOSITS,
Freshwater Biological Association, Ambleside (England).
B. M. Jenkin, C. H. Mortimer, and W. Pennington.
Nature, April 1941, Vol 147, p 496-500. 2 fig, 8 ref.

Descriptors: *Cores, *Analytical techniques, *Lakes, *Deposition (Sediments), Peat, Diatoms, Pollens, Sediments, Clays, Bioindicators.
Identifiers: Lake Windermere (England), Echo-sounding machine, Clay bands, Peat bands.

A method for extracting undisturbed core samples from bottom deposits of lakes has been developed. Examination of obtained core samples confirms the value of the echo-sounding machine as a means of providing information on certain types of lake deposits, and, in part, on the climatic and biological history of lakes. Examples of core samples extracted from the bottom of Lake Windermere are described. (Wilde-Wis)
W69-09758

IMPORTANCE OF THE BOIS BRULE RIVER TO RECENT SEDIMENTATION HISTORY OF WESTERN LAKE SUPERIOR,
Wisconsin State Univ., Superior.
For primary bibliographic entry see Field 02J.
W69-09773

2I. Water in Plants

INFLUENCE OF PINYON-JUNIPER CONVERSIONS AND WATER QUALITY ON PERMEABILITY OF SURFACE SOILS,
Utah State Univ., Logan; and Forest Service (USDA), Logan, Utah. Forestry Science Lab.
For primary bibliographic entry see Field 02G.
W69-09472

GROUNDWATER AND VEGETATION IN TWO PEAT BOGS IN NORTHERN MINNESOTA,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 02F.
W69-09569

SOME CHARACTERISTICS OF VEGETATION DEVELOPMENT IN THE FLOODPLAIN OF OB RIVER IN THE TAIGA ZONE (RUSSIAN),
Leningrad State Univ. (USSR).
E. Ye. Rodnyanskaya.
Vestnik, Leningr Univ, No 24, Geol-Geogr, Issue 4, p 127-134, 1968. 8 p, 1 fig, 1 tab, 4 ref.

Descriptors: *Vegetation, *Floodplains, *River basins, Geology, Geomorphology, Climates, Hydrologic porperties, Seasonal, Floods, Runoff.
Identifiers: *USSR, Ob River, Siberia.

Vegetation of floodplains of the Ob River, Siberia, was investigated on the basis of floral, geological, and hydrologic data. The severe climate, long spring, and summer flooding are responsible to a great extent for the vegetation development in the floodplain areas. Grass predominates over trees and shrubs. In general the vegetation of the Ob River plain can be subdivided into 4 altitude belts each of which is characterized by a certain duration of flooding and definite intensity of alluvial accumulation. (Gabriel-USGS)
W69-09700

2J. Erosion and Sedimentation

ASPECTS OF CARBONATE SEDIMENTATION ON THE ATLANTIC CONTINENTAL SHELF OFF THE SOUTHERN UNITED STATES,
Duke Univ., Durham, N.C. Dept. of Geology; and Duke Univ., Durham, N.C. Marine Lab.
Orrin H. Pilkey, Blake W. Blackwelder, Larry J. Doyle, Ernest Estes, and P. Michael Terlecky.
J Sediment Petrol, Vol 39, No 2, p 744-768, June 1969. 25 p, 15 fig, 4 tab, 32 ref.

Descriptors: *Sedimentation, *Limestones, *Carbonates, *Atlantic Coastal Plain, *Continental shelf, Particle size, Shallow water, Particle shape, Sedimentation rates, Sedimentology, Geochemistry, Sedimentary structures.
Identifiers: Atlantic Continental Shelf.

Over 1,000 sediment samples from the Atlantic continental shelf off the southern United States were investigated to determine the usefulness of the carbonate fraction in studying shelf history in a so-called 'noncarbonate' area. Particle characteristics of the carbonate fraction are emphasized. These include particle rounding and the proportions of fragmental, blackened, and of worn versus fresh components. The abundance of carbonates is mainly a function of the amount of dilution by terrigenous materials from Piedmont rivers. Calcium carbonate is least abundant on the Georgia shelf and increases greatly to the south and slightly to the north. The abundant of black shells, oolites, and shallow water fauna over large portions of the shelf shows a shallow-water origin of much of the shelf surficial material. The abundance of worn and broken shells reflects the low rate of sedimentation. Much of the present shelf sediment cover was originally deposited in the nearshore zone of the last transgressing sea, not the beach environment, as indicated by particle roundness. The areal distribution of certain carbonate fraction parameters can be interpreted as linear patterns paralleling the present shorelines. These may reflect ancient shorelines. (Knapp-USGS)
W69-09492

SUMMARY OF RESERVOIR SEDIMENT DEPOSITION SURVEYS MADE IN THE UNITED STATES THROUGH 1965.
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.

US Department of Agriculture, Misc Publication No 1143, May 1969. 64 p. Dendy, F. E., and Champion, W. A., Compilers.

Descriptors: *Reservoir silting, *Sedimentation, *On-site data collections, *United States, Documentation, Surveys, Watersheds (Basins), Sediment yield, Drainage systems, Inter-Agency Comm on Water Resources, Publications.
Identifiers: *Water Resources Council, Data sources.

Data from reliable reservoir sedimentation surveys made in the United States through 1965, and from surveys made after 1965 for a few reservoirs, are presented in a summary table. All of the 48 conterminous States, except Maine and Florida, and Puerto Rico, are included. An index of river basin maps and a sample form for reporting the data are given. This publication supersedes and updates USDA Miscellaneous Publication 964, published in May 1964. All surveys reported in that bulletin have been repeated here. Reservoirs are grouped according to the 79 drainage areas as divided by the Subcommittee on Hydrology, Federal Inter-Agency River Basin Committee, now under jurisdiction of the Water Resources Council. Surveys range from reconnaissance measurements of sediment depth at a few locations to detailed surveys based on closely spaced cross sections or contours. Total drainage area includes the reservoir and area lying above all upstream dams but generally excludes noncontributing areas within the basin boundary. Where available, USGS drainage area figures are used. (Lang-USGS)
W69-09493

SEDIMENT BUDGET ALONG A BARRIER ISLAND CHAIN,
Smithsonian Institution, Washington, D.C.; and George Washington Univ., Washington, D.C.
J. W. Pierce.
Sediment Geol, Vol 3, No 1, p 5-16, Mar 1969. 12 p, 4 fig, 1 tab, 23 ref. Grant No G-16362 (NSF).

Descriptors: *Sedimentation, *Sedimentation rates, *Islands, *Barriers, *Provenance, Coasts, Mapping, Erosion, Biomass, Tertiary period, Dunes, Wind erosion, Topography, Sands, Saltation, Petrography, Continental shelf, Currents (Water), Waves (Water).
Identifiers: North Carolina coastal sedimentation.

Physiographic changes along a coast are used to define the sediment budget of a stretch of the coast, if reliable historical records are available. This physiographic method was applied to the study of the North Carolina coast located between Cape Hatteras and Cape Lookout. The accretion of sediment has occurred at the average annual rate of 796,000 cubic meters with the material supplied by longshore drift, transportation from the mainland, and the continental shelf acting as a reservoir of the sediment that is presently accreting in the nearshore area. (Gabriel-USGS)
W69-09494

THERMAL AND ELECTRICAL CONDUCTIVITIES OF SANDSTONE ROCKS AND OCEAN SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Oceanography; and National Academy of Sciences-National Research Council, Washington, D.C. Div. of Earth Sciences.
For primary bibliographic entry see Field 02F.
W69-09498

RESTORATION OF GULLIED VALLEY FLOORS IN ARID AND SEMIARID REGIONS,
Geological Survey, Washington, D.C.
Norman J. King.
Proc 23rd Int Geol Congr, Vol 12, p 187-195, 1968. 9 p, 2 fig, 16 ref.

Descriptors: *Accelerated erosion, *Gully erosion, *Erosion control, Land management, Runoff, Aggradation, Check structures, Diversion structures, Slope protection, Soil conservation, Vegetation establishment.
Identifiers: Eroded land restoration, Semiarid regions.

The causes and effects of accelerated soil erosion in overgrazed grassed valleys are discussed and methods of restoring gullied land are outlined. Runoff and erosion are increased by soil compaction and by removal of plant cover. Studies of ephemeral stream channels show that natural processes of gully widening and meandering tend to result ultimately in aggradation. Aggradation can also be increased by artificial obstructions placed in channels or by decreasing discharge. Not all gullied valleys are equally amenable to treatment. The areas where some aggradation is already taking place respond best. Narrow rapidly eroding gullies should be allowed to widen before starting treatment. Runoff control should be applied evenly over an eroding basin so that aggradation is as uniform as possible. Runoff control measures should be applied mainly to noneroding parts of basins so that as much water as possible, and as little sediment as possible is withheld from the gully net. This increases aggradation in channels at the same time it retards reservoir silting in water control structures. (Knapp-USGS)
W69-09506

MEASUREMENT OF SAND TRANSPORT IN RIVERS WITH SPECIAL REFERENCE TO TRACER METHODS,
Hydraulics Research Station, Wallingford (England).
M. J. Crickmore.
Sedimentology, Vol 8, No 3, p 175-228, May 1967. 54 p, 28 fig, 1 plate, 6 tab, 30 ref, append.

Descriptors: *Sediment transport, *Bed load, *Rivers, *Tracers, Tracking techniques, Model studies, Hydraulic models, Estuaries, Sands, Silts, Radioactivity techniques, Dye releases, Statistical methods.
Identifiers: Bed load tracers.

Tests were made on a small river to examine the practicability of tracer measurements of sand transport in rippled beds in natural channels. The spatial integration, time integration, and steady dilution methods were examined by using radioactive and fluorescent tracers. The serious limitations of the time integration and steady dilution methods under conditions of unsteady solids discharge were exposed by a sudden flood discharge occurring during the course of the study. An approximate method

based on the time integration approach but also requiring some spatial tracer data yields an estimate of the transport in the case of highly variable sand discharge, but the spatial integration method offers the most workable and informative tracer method for use in natural rivers. The results were generally consistent with those given by the summation of the measured suspended solids flux and bed load, determined from the downstream advance of ripple bed-forms. Methods are described for bed load estimation from ultrasonic echo sounder records of bed profiles. Sand transport values are calculated for a number of river discharges and for 2 laboratory channel tests using various procedures by Einstein, Bagnold, Meyer-Peter and Muller, and Laursen. Significant differences in the computed values for individual flow conditions are observed. (Knapp-USGS)
W69-09507

METHODS OF STRUCTURAL AND GEOMORPHOLOGICAL ANALYSIS OF RIVER VALLEYS (RUSSIAN),
Kharkov State Univ. (USSR).
For primary bibliographic entry see Field 02A.
W69-09514

SUCCESSFUL SAND CONTROL DESIGN FOR HIGH RATE OIL AND WATER WELLS,
Signal Oil and Gas Co., Los Angeles, Calif.
David H. Schwartz.
J Petrol Technol, p 1193-1198, Sept 1969. 6 p, 4 fig, 4 tab, 19 ref.

Descriptors: *Design criteria, *Water wells, *Well filter, *Gravels, *Sands, Filtration, Erosion control, Cohesionless soils, Sediments.
Identifiers: *Gravel packs, Sand control (Water wells).

Methods for sand control in high-rate water and oil wells are outlined. Gravel pack design criteria are given for various unconsolidated sands, flow velocities, and well fluids. Design procedures are given in detail. (Knapp-USGS)
W69-09649

SEDIMENTATION OF RESERVOIRS,
Central Soil Mechanics Research Station, New Delhi (India).
I. C. dos M. Pais-Cuddou, and N. C. Rawel.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR3, Pap 6789, p 415-429, Sept 1969. 15 p, 8 tab.

Descriptors: *Reservoir silting, *Bed load, *Suspended load, Reservoir storage, Sediment load, Forecasting, Sedimentation, Sediment yield, Silts, Sands, Gravels.
Identifiers: *India, Reservoir sedimentation studies.

The methods of estimating reservoir sedimentation used in India are outlined. During the planning stage, the only method available for predicting the life of a reservoir or the sedimentation rate is to conduct sediment observations on the river. Accurate measurement of suspended sediment load, assumption of the required quantity of bed load, unit weight of sediment, and proportion of the grades of sediment likely to be deposited are some of the important items which need to be taken into consideration. After a reservoir has been built, the rate of sediment deposition can be determined either by measurement of inflow and outflow of sediment or by conducting actual capacity surveys of the reservoir by echo sounding instruments. The latter method is comparatively more accurate and the results obtained are well within 10% of the true value. Contrary to previous experience, it has been found that the percentage of fine-grade sediment trapped in the reservoir is considerably higher than the coarse and medium grade of sediment. Several factors control the location of sediment deposits in the reservoir. The reservoir operation schedule is one of the major factors as well as the shape and size of the reservoir, amount and characteristics of the sediment load, valley slope, and vegetation at the head of reservoir. It has been found that the sediment deposition is not only restricted to dead storage but that it also affects the live storage space. (Knapp-USGS)
W69-09657

SOIL EROSION CONTROL PRACTICES IN PERSPECTIVE,
Harza Engineering Co., Chicago, Ill.
Paul Jacobson.
J Soil and Water Conserv, Vol 24, No 4, p 123-126, Aug 1969. 4 p, 2 fig, 10 ref.

Descriptors: *Soil erosion, *Erosion control, *Check structures, *Farm management, Contour farming, Embankments, Land forming, Land management, Slope protection, Soil conservation, Strip cropping, Terracing, Water control.
Identifiers: *Tillage practices.

Many standard soil erosion control practices have proven impossible to sell to farmers, and some are no longer applicable to farming practices now in use. The standard practices are reviewed and suggestions are made for their modification or replacement in cases of lack of use or obsolescence. Contouring is not suitable for large-scale mechanized farming in humid areas. Crop rotation is no longer necessary to add nitrogen, and is not used by farmers who do not need grass crops. Strip cropping is seldom used in corn areas or by non-users of grass. Terracing is effective if constructed properly but more research on the relation of terrace shape to land and climate conditions is needed to utilize the system well. Tillage practices are used well in many cases, but more need to be established for various crop-weather-runoff situations. It is concluded that Corn Belt farmers will accept only no-flow till-plant minimum tillage programs with water control by storage fills across waterways. Use of this system can reduce downstream sediment and nutrient loads to very low levels. (Knapp-USGS)
W69-09660

SOIL EROSION AND CONSERVATION IN NORTHERN JORDAN,
Durham Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 04D.
W69-09663

OSCILLAXANTHIN IN THE SEDIMENT OF LAKE WASHINGTON,
Washington Univ., Seattle, Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W69-09675

SEDIMENT MOVEMENT IN AN AREA OF SUBURBAN HIGHWAY CONSTRUCTION, SCOTT RUN BASIN, FAIRFAX COUNTY, VIRGINIA, 1961-64,
Geological Survey, Washington, D.C.
R. B. Vice, H. P. Guy, and G. E. Ferguson.
Geol Surv Water-Supply Pap 1591-E, p E1-E41, 1969. 41 p, 13 fig, 11 tab, 10 ref.

Descriptors: *Sediment yield, *Urbanization, *Road construction, *Virginia, Highways, Runoff, Soil erosion, Sediment load, Sampling, Surveys, Excavation, Water pollution sources, Water pollution effects, Sedimentation.
Identifiers: Highway construction sediment yield, Fairfax County (Va).

Movement of sediment during a period of intensive highway construction was studied in the Scott Run basin, Fairfax County, Va., from 1961 to 1964. The 4.54 sq mi drainage basin, which empties into the Potomac River about 6 mi above the head of the Potomac Estuary, was the scene of highway construction covering 11% of the basin; other types of urban construction in the basin during this time were minor. Sediment was measured at the gaging station by a system of representative samples. These samples made it possible to document the sediment yield for 88 storm events representing the overland runoff. The 88 events accounted for 37% of the runoff and 99% of the sediment movement in 3% of the time. The highway construction areas, varying from less than 1 to more than 10% of the basin at a given time, contributed 85% of the sediment; 38% of the sediment movement occurred during April, May, and June, and only 11% occurred during July, August, and September; and on the basis of residual soil and stream-sediment particle sizes, the amount of sediment eroded from areas of construction was about twice that transported from the basin. Sediment yield is about 10 times that normally expected from cultivated land, 200 times that expected from grassland, and 2,000 times that expected from forest land. (Knapp-USGS)
W69-09683

CONTROL OF SEDIMENTATION AND BOTTOM CONFIGURATION BY CONVECTION CURRENTS, LAKE WASHINGTON, WASHINGTON,
Humble Oil and Refining Co., Houston, Tex.; and Coast Guard, Woods Hole, Mass.
For primary bibliographic entry see Field 02H.
W69-09757

IMPORTANCE OF THE BOIS BRULE RIVER TO RECENT SEDIMENTATION HISTORY OF WESTERN LAKE SUPERIOR,
Wisconsin State Univ., Superior.
A. B. Dickas, and P. C. Tychsen.
Wisc State Univ, Research Report, 1969. 21 p. OWRR Proj A-023-Wis.

Descriptors: *Sedimentation, Lake Superior, Wisconsin, Petrology, Suspended-load.
Identifiers: *Bois Brule River (Wis), *Sedimentary analysis, Sedimentation history.

A sedimentary analysis was made of the bed and suspended load of the Bois Brule River, Douglas County, Wisconsin to better understand the statistical characteristics of the clastic materials being transported by this stream and its contribution to the Holocene sedimentation history of the Wisconsin shoreline of Lake Superior. In addition bedrock and glacial deposits were mapped throughout the drainage basin. The average mean size distribution of the clastic load, based on the phi scale, is as follows: 10% granules, 74% sand, 13% silt and 3% clay. To determine whether this dominantly sand-sized sediment was derived from basement rock or glacial debris, stream gravels larger than granule size were petrographically analyzed and compared to surficial and basement rock maps. Results indicate that the glacial cover is the prime source of the clastic material of the river load, concurring with the mapping program which shows that outwash sands and reworked glacial drift predominate over much of the drainage area. A secondary source is outcropping Keweenawan (Cambrian) sandstones. Earlier studies indicate the river load is deposited in Lake Superior out to a distance of one-half to one mile from the shoreline with the finer material found at the greater distance from the littoral zone.
W69-09773

2K. Chemical Processes

HYDROCALCITE AND NESQUEHONITE IN CARBONATE SCALES,
Heidelberg Univ. (West Germany). Sediment Lab.
Hannelore Marschner.
Science, Vol 165, No 3898, p 1119-1121, Sept 12, 1969. 3 p, 1 fig, 3 tab, 6 ref.

Descriptors: *Scaling, *Calcium carbonate, *Magnesium carbonates, Hardness (Water), Calcite, Limestones, Carbonate rocks, Chemical precipitation, Water chemistry, Chemical reactions.
Identifiers: *Hydrocalcite.

Hydrocalcite with exactly one molecule of hydrate water is the main component of carbonate scales deposited from cold water in contact with air. When the magnesium content of the water is high, the hydrocalcite occurs together with nesquehonite. From the conditions under which hydrocalcite is transformed into calcite and aragonite., it appears that in some cases aragonite in nature may be formed by way of an intermediary of hydrocalcite. (Knapp-USGS)
W69-09449

ON THE INTERACTION OF WATER MOLECULES AND MONTMORILLONITE SURFACES,
Adelaide Univ. (Australia). Dept. of Agricultural Biochemistry and Soil Science.
For primary bibliographic entry see Field 02G.
W69-09481

KINETICS OF THE FORMATION AND BREAKDOWN OF A CA-MONTMORILLONITE TACTOIDS,
Negev Inst. for Arid Zone Research, Beersheba (Israel). Dept. of Mechanics of Soil and Materials.
I. Shainberg, and A. Kaiserman.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 547-551, July-Aug 1969. 5 p, 5 fig, 8 ref.

Descriptors: *Ion exchange, *Clays, *Montmorillonite, Ion transport, Sodium, Calcium, Flocculation, Colloids, Adsorption, Diffusion.
Identifiers: *Tactoid formation.

The kinetics of Ca-montmorillonite tactoid formation and breakdown was followed by recording the changes in light transmission as a function of time when Ca-montmorillonite suspensions of 0.05% (w/v) concentration were added to Na-montmorillonite suspensions of the same concentration in a titrating vessel placed in the light path of a specrophotometer. Tactoid formation was found to be instantaneous whereas the breakdown of Ca tactoids took about 10 min. It was suggested that the initial step upon mixing sodium and calcium montmorillonite was the redistribution of adsorbed ions. For tactoids to break, ions have to interdiffuse into the tactoids. Since the mobility of ions adsorbed on the internal surfaces is low, tactoid breakdown is slow. Ion diffusion on the single platelets of Na clay and the external surfaces of the tactoids is high; thus the formation of tactoids is instantaneous. (Knapp-USGS)
W69-09482

LEACHING OF ADDED SELENIUM FROM ALKALINE SOILS AS INFLUENCED BY SULFATE,
Agricultural Research Service, Kimberly, Idaho. Northwest Branch Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02G.
W69-09483

CONTROL OF POTASSIUM RELEASE AND REVERSION ASSOCIATED WITH CHANGES IN SOIL MOISTURE,
Iowa State Univ. of Science and Technology, Ames. Dept. of Soil Science.
T. E. Bates, and A. D. Scott.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 566-568, July-Aug 1969. 3 p, 1 fig, 2 tab, 5 ref.

Descriptors: *Ion exchange, *Potassium, *Soils, *Wetting, *Drying, Hysteresis, Nutrients, Leaching, Ion transport, Soil moisture, Soil water movement, Organic matter.
Identifiers: Potassium fixation.

The changes in exchangeable K that occur when soils are dried and rewet, and the affect of organic additives on these changes were determined with 20 soils from the North Central Region of the USA. The release of K associated with drying was essentially eliminated by adding dextrose to the soils before drying. The use of dried samples for the determination of the exchangeable K in field-moist soils will be limited to some extent, however, because some soils fix K when the are dried and dextrose does not prevent fixation. In most cases, a decrease in exchangeable K occurred when air-dry soils were rewet. A greater decrease in exchangeable K was attained with all soils when the air-dry, rewet samples were redried in the presence of octanol. In some cases, only the reversion of K released by drying was involved, and the decrease was not enough to reduce the exchangeable K level to that in undried soil. In others, K fixation occurred and the heated soils contained less exchangeable K after treatment than they had in their field-moist state. Nevertheless, the octanol treatment resulted in improved estimates of plant-available K and of exchangeable K in undried soil samples over those obtainable with either air-dry or air-dry rewet samples. (Knapp-USGS)
W69-09484

HYDROLOGIC AND MORPHOLOGIC IMPLICATIONS OF ANISOTROPY AND INFILTRATION IN SOIL PROFILE DEVELOPMENT,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering; and Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 02G.
W69-09485

CHEMICAL AND BIOLOGICAL WEATHERING IN VERMICULITE FROM TRANSVAAL,
Yale Univ, New Haven, Conn. School of Forestry.
B. L. Sawhney, and G. K. Voigt.
Soil Sci Soc Amer Proc, Vol 33, No 4, p625-629, July-Aug 1969. 5 p, 5 fig, 16 ref.

Descriptors: *Weathering, *Soils, *Mineralogy, *Clays, Ion exchange, Salts, Solutes, Aqueous solutions, Expansive clays, Expansive soils, Leaching, Chemical reactions, Biodegradation.
Identifiers: *Vermiculites, Interlayer expansion, Electron microprobe analysis, Structure (Mineralogic).

Transvaal vermiculite flakes were weathered in solutions of salts or acids as well as in nutrient solutions inoculated with water extracts of soils from hemlock (Tsuga canadensis) and tulip poplar (Liridendron tulipifera) forest stands. Morphological changes were studied with a microscope and the structural changes were determined by X-ray diffraction analysis, while the changes in chemical composition were estimated by an electron microprobe. Weathering of flakes proceeded from edges inward and produced a weathered zone parallel to the flake edges. However, the changes produced by salt solutions were different from those by acids and biological agents. Treatment with salt solutions produced the expanded weathered zone with the 14A c-axis spacing as compared to 10A spacing of the unaltered zone. Electron microprobe analysis revealed that the salt treatment replaced the interlayer K ions by the hydrated cations of the salt. Treatment with acids or biological agents, on the other hand, produced a bleached and fragile weathered border that was amorphous to X-rays. Electron microprobe analysis showed that the bleached zone was depleted of Fe, Mg, and Al, besides the interlayer K ions; concentration of these cations decreased towards the extremity of the edge. The amorphous nature of the weathered zone is attributed to the loss of the unit cell periodicity resulting from the removal of a portion of the octahedral and tetrahedral cations. (Knapp-USGS)
W69-09489

THE EMF OF PLATINUM ELECTRODES IN DILUTE SOLUTIONS AND ITS RELATION TO SOIL pH,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
H. L. Bohn.
Soil Sci Amer Proc, Vol 33, No 4, p 639-640, July-Aug 1969. 2 p, 1 tab, 11 ref.

Descriptors: *Soil water, *Water chemistry, *Electrochemistry, *Instrumentation, *Calibrations, Electrodes, Electrical properties, Aqueous solutions, Hydrogen ion, concentration, Oxidation-reduction potential.
Identifiers: Electrode potentials, Platinum electrodes.

An equation is derived for mixed potentials of electrodes which explains their non-Nernstian behavior in dilute solutions and at nonequilibrium conditions. Adding iron (II) sulfate to soil suspensions resulted in E/pH slopes which were unrelated to the reaction taking place because E is a mixed potential and because the pH is governed to a significant extent by non-redox reactions. (Knapp-USGS)
W69-09490

FIELD DETERMINATION OF SULFATE CONTENT IN SOILS,
California State Dept. of Water Resources, Sacramento.
H. J. Miller, and D. G. Knight.
Tech Memo No 37, Dept Water Resour, Calif, Jan 1969. 10 p, 4 fig, 1 plate, 1 ref, 2 append.

Descriptors: *Chemical analysis, Chemical precipitation, Gypsum, *Sulfates, Test procedures, Volumetric analysis, Quantitative analysis, Soil analysis, Soil investigations, *Soil tests, Field tests, Subsurface investigations, Engineering geology, Soluble salts, Soil chemistry.
Identifiers: Sulfate attack.

A rapid chemical test, developed for determining sulfate in natural soils, is based on the direct relationship between sulfate content and the volume of white precipitate. The soil sample is placed in 3N HCl to dissolve the sulfate, the solution is filtered into a graduated test tube, and barium chloride is added to the filtrate to precipate the sulfate. The volume of the precipitate is read directly in the test tube. Test tubes are calibrated with standard samples. A testing kit developed for field use is described. (USBR)
W69-09530

EFFECT OF LIGHT INTENSITY ON PHOTOSYNTHESIS BY THERMAL ALGAE ADAPTED TO NATURAL AND REDUCED SUNLIGHT,
Indiana Univ., Indianapolis. Dept. of Microbiology.
Thomas D. Brock, and M. Louise Brock.
Limnol and Oceanogr, Vol 14, No 3, p 334-341, May 1969. 8 p, 7 tab, 19 ref.

Descriptors: *Photosynthesis, *Algae, *Thermal springs, *Light intensity, Spring water, Water chemistry, Water temperature, Chemical analysis, Analytical techniques, Cloud cover, Spectroscopy, Ultraviolet radiation, Transmissivity, Chlorophyll.

The effect of light intensity on thermal algae of hot springs of Yellowstone National Park was investigated by measuring autoradiography of photosynthetic activity of cells at different levels in the algae mat. The rate of photosynthesis decreases progressively with decreasing light, although the most efficient use is at 7-14% of full sunlight. The chlorophyll content of the algae at the surface of the mat increases rapidly; however, the chlorophyll content of the mat increases slowly or not at all. Although individual algae cells can adapt rapidly to changes in light, the entire population, because of its existence in compact mats, adapts slowly. At the latitude of Yellowstone there is sufficient light throughout the whole year to stimulate the algae growth even at critical temperatures. (Gabriel-USGS)
W69-09676

SOME PHOTOSYNTHETIC CHARACTERISTICS OF A NATURALLY OCCURRING POPULATION OF OSCILLATORIA AGARDHII GOMONT,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
For primary bibliographic entry see Field 02H.

W69-09678

CHEMICAL SEPARATION AND SPECTROCHEMICAL DETERMINATION OF MICROGRAM QUANTITIES OF GERMANIUM IN NATURAL WATER OF HIGH HEAVY-METAL CONTENT,
Geological Survey, Sacramento, Calif.
Alex E. Dong.
Geol Surv Ann Rev, Short Pap Contrib, 1969.

Descriptors: *Germanium, *Trace elements, *Spectroscopy, *Water chemistry, Geochemistry, Chemical techniques, Saline water, Heavy metals.
Identifiers: Chemical separation, Natural water.

A procedure is described for the chemical separation and determination of microgram quantities of germanium in water of high heavy-metal content. Before being subjected to spectrochemical determination, germanium is selectively isolated from other major and minor elements in water in order to avoid undesirable dilution effects. The average error for 8 determinations is about 8.5% and the relative standard deviation is 8.0%.
W69-09684

SOLVENT STABILITY AND RECOVERY IN SOLVENT EXTRACTION DESALINATION,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 03A.
W69-09692

THE CALCIUM, MAGNESIUM, POTASSIUM, AND SODIUM BUDGETS FOR A SMALL FORESTED ECOSYSTEM,
Dartmouth Coll., Hanover, N.H. Dept. of Biological Sciences.
G. E. Likens.
Ecology, Vol 48, No 5, p 772-785, 1967. 8 fig, 11 tab, 41 ref.

Descriptors: *Calcium, *Magnesium, *Potassium, *Cycling nutrients, *Ecosystems, *Forests, New Hampshire.
Identifiers: Cation losses, Balance (Exchangeable bases), Weathering rates, Hubbard Brook Experimental Forest (NH), New Hampshire.

The balance of exchangeable bases was studied in six watersheds of the Hubbard Brook Experimental Forest, N H, forested by northern hardwoods, with some spruce and fir at higher elevations. Samples of precipitation and stream water were collected from June 1963 until June 1965. The budget of dissolved cations was calculated from input (concentration of cations times volume of precipitation) and discharge (concentration of cations times volume of runoff). During 1963-1965, the average annual inputs (in kilograms/hectare) were: calcium (Ca) 2.9, magnesium (Mg) 0.9, potassium (K) 2.15, sodium (Na) 1.55, while the discharge averaged calcium 5.95, magnesium 2.2, potassium 1.45, and sodium 5.2. The net loss of calcium, magnesium, and sodium represents conservative measurement of weathering. The potassium budget approaches balance, and this cation may serve as the sensitive index of biological activity. (Wilde-Wis)
W69-09750

THE CONCEPT OF PRODUCTIVITY IN BIOLOGY (GERMAN),
August Thienemann.
Archiv fur Hydrobiologie, Vol 22, p 616-622, 1931.

Descriptors: *Productivity, Fertility, Aquatic productivity, Lakes, Ponds, Nutrients, Harvesting.
Identifiers: Productive potential, Actual productivity, Site quality.

This is a discussion of the manifold meaning of the term 'productivity', or 'site quality' of different media of production, including lakes and ponds. This expression in hydrobiology, as in forestry or farming, involves several concepts: 'fertility of a medium,' referring primarily to the supply of available nutrients; 'productive potential,' implying a possibility of utilization of the medium by suitable forms of life, i.e., fish, trees, or farm crops; 'actual productivity,' depending to a large degree upon the organisms which at the present occupy the substrate, their rate of growth and value to man. In many instances, the actual productivity of a medium is far below its productive potential. (Wilde-Wis)
W69-09751

IONIC COMPOSITION OF SAGEHEN CREEK, CALIFORNIA, FOLLOWING AN ADJACENT FIRE,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition; and California Univ., Berkeley. Dept. of Zoology.
C. M. Johnson, and P. R. Needham.
Ecology, Vol 47, No 4, p 636-639, Summer 1966. 2 fig, 2 tab, 8 ref.

Descriptors: *Ions, *Streams, *Forest fires, Hydrogen ion concentration, Bicarbonates, Calcium, Magnesium, Sodium, Potassium, California, Springs, Water chemistry.
Identifiers: Sagehen Creek (Calif), Donner Ridge (Calif), Sagehen Basin (Calif).

Water samples from Sagehen Creek, Calif, were collected at biweekly intervals for two years following the Donner Ridge forest fire which burned over the lower part of Sagehen Basin in 1960. Sampling included a spring which feeds the stream above the burned area and two sites in the stream, one above the burned area below the spring, and one within the burned area. Analyses included pH, bicarbonate, calcium, magnesium, sodium, and potassium. Seasonal variation in ionic composition was observed at both sampling sites. In contrast to the constant composition of the spring water for the two year period, the ionic concentration in the samples was inversely related to streamflow. In summer, streamflow was low and stream ionic concentrations equalled or exceeded those of the spring water. During runoff from melting snow (March-June), streamflow increased greatly and ionic concentration decreased. There was no specific effect of the fire on the ionic composition of the stream. It is postulated that ash constituents were dissolved by light rainfall and leached into the permeable forest soil before the first snow. Because of acid soil, the dissolved cations were adsorbed by exchange colloids rather than washed into the stream. (Wilde-Wis)
W69-09753

ASSAY OF UREASE ACTIVITY USING CARBON 14-UREA IN STORED, GEOLOGICALLY PRESERVED, AND IN IRRADIATED SOILS,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
J. J. Skujins, and A. D. McLaren.
Soil Biology and Biochemistry, Vol 1, p 89-99, 1969. 8 fig, 3 tab, 34 ref.

Descriptors: *Soils, *Soil analysis, Nitrogen cycle, Enzymes, Irradiation, Carbon, Hawaii, Radioisotopes, Radioactive dating, Puerto Rico, Alaska.
Identifiers: *Urease activity, *Carbon-14, Sample storage, Sterilization, Hilgard soil collection.

During a period of 26 months of air-dry storage of Hawaiian and Puerto Rico latosols, one soil showed an increase in activity to 108.5% and others a decrease to as little as 36%. Urease activity found in 6 to 12 years stored, air-dry agricultural soils correlated with the organic matter content rather than with the numbers of microorganisms. In samples from the 60-years-old Hilgard soil collection, urease activity reflected both the organic carbon content and the numbers of organisms present. Measurable urease activities were detected in 8715 and 9550-years-old, radiocarbon dated, Alaska permafrost samples. No activity was detected in a 32,000-years-old sample. No urease activity was present in two high-salinity soils. Urease activity was usually found in neutral soils. A high-energy electron-beam irradiation dosage of 4 Mrad increased urease activity in some soils, but decreased activity in two others. Doses of 8 Mrad decreased urease activity below their native levels in all soils. Evidently, an intracellular urease component becomes more accessible to substrate upon death of organisms. A new method for urease activity determination in soils was devised, based on the detection of carbon-14-labelled carbon dioxide release from carbon-14-urea-amended soils. (Keeney-Wis)
W69-09756

2L. Estuaries

ASPECTS OF CARBONATE SEDIMENTATION ON THE ATLANTIC CONTINENTAL SHELF OFF THE SOUTHERN UNITED STATES,
Duke Univ., Durham, N.C. Dept. of Geology; and Duke Univ., Durham, N.C. Marine Lab.
For primary bibliographic entry see Field 02J.
W69-09492

SEDIMENT BUDGET ALONG A BARRIER ISLAND CHAIN,
Smithsonian Institution, Washington, D.C.; and George Washington Univ., Washington, D.C.
For primary bibliographic entry see Field 02J.
W69-09494

GROUNDWATER FLOW IN THE NETHERLANDS DELTA AREA AND ITS INFLUENCE ON THE SALT BALANCE OF THE FUTURE LAKE ZEELAND,
Institute for Land and Water Management Research, Wageningen (Netherlands).
L. F. Ernst.
J Hydrol, Vol 8, No 2, p 137-172, June 1969. 36 p, 11 fig, 5 tab, 42 ref.

Descriptors: *Water quality, *Saline water systems, *Groundwater movement, *Saline water intrusion, *Drainage systems, Streamflow, Water chemistry, Mathematical models, Saline water-freshwater interfaces, Diffusion, Water balance.
Identifiers: *Netherlands, Polders, Lake Zeeland.

Five estuaries in the southwest of the Netherlands will be shut off from the sea by large dams, which will be completed about 1980. The sea branches between Walcheren-Zuid-Beveland and Goeree-Overflakkee will form the new Lake Zeeland. A partial diversion of the discharge of the rivers Rhine and Meuse through the new lake will have a favorable influence on the desalting of the lake. A calculation of the rate of desalting is important in view of the possibilities of domestic, agricultural and industrial use of this water. When, after some years, the salt concentration of the lake decreases considerably, water flow to the low-lying polders by differences in head, and to the deep tidal channels by differences in density will become important. The groundwater flow below the large enclosing dam and the salt diffusion in the groundwater beneath the lake will be of minor importance. The very small volume of fresh groundwater, now mainly present in the top layers of the higher polders, will increase by the intrusion of freshwater from the lake into the deeper layers. By making use of an approximative assumption about the mixing of the water in the lake and by ignoring seasonal fluctuations and differences between wet and dry years, simple water and salt balance formulae were obtained, by which it could be shown that large amounts of river water will be required to obtain a satisfactory decrease of the mean salt concentration of the lake water. (Knapp-USGS)
W69-09666

AN INTERFACE PROBLEM WITH A SOURCE AND A SINK IN THE HEAVY FLUID,
Technische Hogeschool, Delft (Netherlands).
A. Verruijt.

J Hydrol, Vol 8, No 2, p 197-206, June 1969. 10 p, 3 fig, 5 ref, append.

Descriptors: *Saline water-freshwater interfaces, *Groundwater movement, Saline water intrusion, Model studies, Hydraulic models, Mathematical models.
Identifiers: Hodographs, Hele-Shaw models.

The hodograph method is explained and used to solve the groundwater flow problem of a source and a sink in the heavy fluid of a 2-fluid system, the lighter fluid being stationary. The results of the calculations have been verified experimentally by means of a test in a Hele-Shaw model. (Knapp-USGS)
W69-09668

DUNE SAND AND SOIL STRATA IN QUARTERNARY SEDIMENTARY CYCLES OF THE SHARON COASTAL PLAIN,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering; and Hebrew Univ., Jerusalem (Israel). Dept. of Agricultural Engineering.
D. Karmeli, D. H. Yaalon, and Israela Ravina.
Israel J Earth-Sci, Vol 17, No 2, p 45-53, Apr 1968. 9 p, 3 fig, 4 tab, 18 ref.

Descriptors: *Aquifers, *Arid lands, Soils, Sedimentation, Dunes, Sands, Aeolian soils, Coasts, Deposition (Sediments), Sedimentary structures, Wind erosion.
Identifiers: *Israel.

Quantitative data of sediment characteristics were obtained from cores on Quaternary sandy ridges in the Pardes Hanna and Givat Hayyim areas. Constructional cycles of dune sand accumulation and soil development were identified. The uniform distribution of fines in the total thickness of the soil stratum irrespective of its position on the ridge indicates an aeolian origin of the clay and its imbedding into the soils by leaching. Topographic differences are the main factor causing the development of the different soils. The total amount of fines in a soil stratum may be a useful parameter for subsurface correlations and for estimating the rate of aeolian deposition. (Knapp-USGS)
W69-09691

CHANGES IN THE WATERS OF THE DANUBE REGION IN THE BLACK SEA AND THE EFFECT ON ANCHOVY BREEDING,
Odessa State Univ. (USSR). Dept. of Hydrobiology.
M. L. El'-Sayed.
Transl by Scripta Technica from Okeanologiya, Akad Nauk, SSSR, Vol 8, No 4. Oceanology, Vol 8, No 4, p 569-572, 1968. 4 p, 2 fig, 8 ref.

Descriptors: *Mixing, *Spawning, *Water temperature, Density stratification, Freshwater, Saline water, Salinity, Limnology, Fish reproduction, Breeding.
Identifiers: *Anchovy spawning, Danube River, Black Sea.

Three major rivers which discharge water into the northwest part of the Black Sea are the Danube, Dnieper, and Dniester. The mixing of fresh and saline water produced a visible stratification of water masses. The following water zones were identified: (1) River water with a salinity of up to 6-7%; (2) Surficial seawater with a salinity of 12-18.5% acid; (3) Bottom water with a salinity of 19.5%. Water samples were collected from the various water zones during 1966 and 1967 in order to establish relationships between temperature, salinity, and biological factors. It was concluded that there is a close relationship between salinity, temperature and distribution of spawning anchovies in the selected area. The number of anchovy spawn was dependent upon the stage of water mixing. The highest number of anchovy spawn was found in a salinity of 16.7-17.3% and a water temperature of 24-26 deg C. The least number was recorded at the mouth of the Danube River where the salinity was between 1-4%. The winds are important in the mixing process and, therefore, in the areal distribution of anchovy spawn. (Carstea-USGS)
W69-09702

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

ION EXCHANGE IS FEASIBLE FOR DESALINATION,
Federal Water Pollution Control Administration, Washington, D.C.
Jacob I. Bregman, and James M. Shackelford.
Environ Sci Tech, Vol 3, No 4, p 336-340, Apr 1969. 5 p, 4 fig.

Descriptors: *Demineralization, *Ion exchange, Dissolved solids, Ions, Saline water, Acids, Alkalis (Bases), Water costs, Economics, pH, *Desalination, *Desalination processes, Water treatment, Water quality, Water chemistry, *Waste water treatment.
Identifiers: Anions, Deionization.

Ion exchange of waste waters having low amounts of total dissolved solids is more economically feasible than chemical regeneration. The recent revival of ion exchange as a desalination process may be attributed to: (1) development of high-capacity ion exchangers for demineralization; (2) development of ingenious techniques for efficient use, recovery, and reuse of resin regenerants; and (3) introduction of exotic, nonresin, ion exchange techniques. New processes using these approaches include the Desal, Sul-bi-Sul, Sirotherm, continuous ion exchange, and liquid ion exchange. Each process is discussed separately. The liquid ion exchange process is particularly adaptable to the removal of magnesium because the system can be made highly selective for that ion. The continuous ion exchange process may be installed for 20% less cost than conventional bed units and requires about one-third less space. One such unit costs $0.10/1000 gal for producing water with 2 ppm total dissolved solids from water containing 250 ppm total dissolved solids. (USBR)
W69-09527

SOLVENT STABILITY AND RECOVERY IN SOLVENT EXTRACTION DESALINATION,
Texas A and M Univ., College Station.
R. R. Davison, and W. H. Smith.
Office Saline Water Res and Develop Progr Rep No 371, Aug 1968. 64 p, 14 fig, 13 tab, 15 ref. OSW Contract 14-01-0001-1180.

Descriptors: *Solvent extractions, *Desalination processes, *Analytical techniques, Ion exchange, Distillation, Gas chromatography, Solvents, Stability, Water temperature, Ozone, Oxygen, Nitrogen, Indicators, Volumetric analysis.
Identifiers: Solvent stability, Amine extraction, Amine analysis.

Studies were undertaken to determine the chemical stability of amine solvents which are used in desalination of seawater, and methods of amine removal from the resulting freshwater. Five secondary and tertiary amines C5 and C6, purified by distillation, were used as experimental materials. The effects of temperature, oxygen, nitrogen, and amine-water mixtures upon stability of selected amines were studied. The degradation of amines was measured by water solubility or cloud points and by gas chromatography. It was concluded that the degradation of amines at 60 deg C was higher than at room temperature. Further, degradation was higher in the presence of oxygen than nitrogen. Therefore, a decrease in oxygen in the system will result in a decrease of amine degradation. The removal of amine solvents from water was investigated by steam stripping, biological methods, ion exchange and ozonation. Trickle filters were found suitable for removal of amine residues, but yeasts, molds and algae apparently reduced the effectiveness of the filters. Laboratory experiments showed that distillation was very effective in amine removal and the process was not pH dependent. However, a few ppm of amine hydrochloride may remain in the product. The ozonation method was neither efficient nor economical. In contrast, the ion exchange method appears to be very effective and economical for removing amines from water. A buffered bromcresol green reagent method used for amine analysis in water is discussed. (Carstea-USGS)
W69-09692

3B. Water Yield Improvement

TIMING OF THE APPARENT EFFECTS OF CLOUD SEEDING,
California Univ., Berkeley. Statistical Lab.
Jeanne L. Lovasich, Jerzy Neyman, Elizabeth L. Scott, and Jerome A. Smith.
Science, Vol 165, No 3896, p 892-893, Aug 29, 1969. 2 p, 1 fig, 1 tab, 7 ref.

Descriptors: *Cloud seeding, *Artificial precipitation, *California, Rainfall, Rain gages, Precipitation (Atmospheric), Temperature, Evaporation, Convection, Weather modification, Water yield.
Identifiers: Cloud seeding effects.

The average hourly precipitation amounts, on 96 experimental days without cloud seeding in the Whitetop experiment, California, show a marked maximum between 4 and 7 o'clock in the afternoon, presumable reflecting the convection activity caused by heating of the ground occurring during an earlier period. No such maximum is observed on the 102 days with seeding. The hypothetical explanation presupposes that seeding with silver iodide creates early general cloudiness, which prevents ground temperatures from rising to levels usually attained on days without seeding. This hypothesis may explain not only the mechanism of the loss of rain in the Whitetop experiment, apparently induced by seeding, but also may explain certain phenomena noticed in another experiment. (Knapp-USGS)
W69-09451

PERFORMANCE OF AN ATMOSPHERIC WATER RESOURCES RESEARCH PROGRAM IN THE HUNGRY HORSE AREA, MONTANA, 1967-68 SEASON.

N Amer Weather Consult, Goleta, Calif, Rep No 97, Nov 1968. 51 p, 14 fig, 10 tab, 7 ref, 2 append.

Descriptors: Atomospheric precipitation, *Cloud seeding, *Snowfall, Benefit-cost ratios, Economics, Storms, Meteorology, Montana, Snowpacks, Streamflow, Temperature, Silver iodide, Runoff, Snowmelt, Performance, Snow, *Weather modification, *Artificial precipitation.
Identifiers: *Atmospheric research, Water content, Kalispell (Mont), Ice nuclei.

Hungry Horse Project is one of the first operational adaptation research projects undertaken as part of the Bureau of Reclamation's Atmospheric Water Resources Program. Hungry Horse Basin, in northwestern Montana, was chosen for such a program because of potential high economic yields from small increases in precipitation over this basin. Seeding operations performed from Oct 1967 through Apr 1968 are discussed. Results of the program are evaluated in terms of streamflow, snowpack water content, analysis of silver content in snow, and investigation of nuclei climatology. Equipment design and construction, functional requirements of each general type of station, and overall system functional capabilities are enumerated. (USBR)
W69-09543

CALIBRATING A WATERSHED BY USING A CLIMATIC DATA,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02A.
W69-09759

A METHOD OF ESTIMATING STREAMFLOW LOSS BY EVAPOTRANSPIRATION FROM THE RIPARIAN ZONE,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02D.
W69-09760

BALTIMORE'S WATERSHEDS: AN EXAMPLE OF INTEGRATED LAND USE,
Forest Service (USDA), Washington, D.C. Div. of Watershed, Recreation, and Range Research; and Bureau of Water Supply, Baltimore, Md.
For primary bibliographic entry see Field 04C.
W69-09761

WILL THE USE OF 2,4,5-T TO CONTROL STREAMSIDE VEGETATION CONTAMINATE PUBLIC WATER SUPPLIES,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station; Pennsylvania State Univ., University Park, Pa.; and Amchem Products, Inc., Ambler, Pa.
For primary bibliographic entry see Field 05B.
W69-09763

3C. Use of Water of Impaired Quality

STANDS FOR AUTOMATION ACHIEVED BY SPRINKLING,
California Univ., Davis.
For primary bibliographic entry see Field 03F.
W69-09655

3D. Conservation in Domestic and Municipal Use

CONSERVATION DISTRICT ACT.

Ill Ann Stat ch 57 1/2, secs 101-121 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Conservation, *Land management, *Administrative agencies, Land resources, Natural resources, Legislation, Financing, Legal aspects, Water law, Project purposes, Recreation, Administration, Wildlife, Wildlife conservation, Habitats, Project planning, Projects, Resource development.
Identifiers: *Conservation districts.

On petition of the voters of a county not organized as a forest preserve district, a conservation district may be formed to promote the conservation of nature, flora and faunna, natural environment, and natural resources of the district. The district's management shall consist of five trustees who serve a five year term. The State Conservation Department shall guide and consult with every district in matters relating to conservation and recreation policies and plans. Every district has the power to enter into contracts; acquire real property; make and publish ordinances; and study the district's wildland and other open space resources with respect to preservation of such resources. Each district is to be financed by an annual levy of taxes on property within its jurisdiction, and when necessary bonds may be issued. (Johnson-Fla)
W69-09626

3F. Conservation in Agriculture

MICROMETEOROLOGICAL METHODS AS TOOLS FOR INCREASING CROP PRODUCTION AND WATER-USE EFFICIENCY,
Agricultural Research Service, Kimberly, Idaho. Snake River Research Center.
James L. Wright.
Pap, Proc Eighteenth Annu Fertilizer Conf Pac Northwest, Twin Falls, Idaho, July 1967. 8 p, 11 ref.

Descriptors: *Crops, *Crop production, *Agronomic crops, Efficiencies, Water utilization, *Micrometeorology, *Meteorology, Microclimatology, Evaporation, Microenvironment, *Irrigation practices, Water management (Applied), *Agronomy, Irrigation efficiency, Plants, Energy balance, Agriculture, Farm management, Environment, Irrigation.

Application of micrometeorological methods to problems of agronomic importance has increased the understanding of physical processes controlling the natural environment of plants. Methods and the basic information gained from using these methods illustrate the importance of microclimatic factors and indicate the applicability to problems of practical importance. Results of micrometeorological studies have increased our understanding of such things as partitioning energy at the surface of the earth, factors controlling the rate of evaporation of water from the surface of the earth, and effects of management practices upon the microclimate of a plant community. A deeper understanding of these basic factors increases the possibility of obtaining (1) more efficient use of water, (2) greater and more economical crop production through improved irrigation management practices, (3) modification of the natural microclimate of a crop, and (4) development of improved crop types that will maximize the beneficial factors of the microclimate. (USBR)
W69-09528

TRAPEZOIDAL FLUMES FOR MEASURING FLOW IN IRRIGATION CHANNELS,
Agricultural Research Service, Kimberly, Idaho.
For primary bibliographic entry see Field 07B.
W69-09532

SALT BALANCE, IRRIGATION EFFICIENCY, AND DRAINAGE DESIGN,
Herman Bouwer.
Proc Amer Soc Civ Eng, J Irrig Drain Div, Vol 95, No IR1, p 153-170, Mar 1969. 18 p, 4 fig, 3 tab, 27 ref, 2 append.

Descriptors: *Salt balance, *Irrigation efficiency, Salts, Irrigation, *Drainage engineering, *Drainage systems, Drainage, Evapotranspiration, Irrigation systems, Leaching, Saline soils, Salinity, Water utilization, Water table, Root zone, Crops, Water requirements, Consumptive use, Salt tolerance, Time, Bibliographies.
Identifiers: Irrigation requirement, Salt removal.

A simplified procedure is presented to predict the amount of irrigation water necessary (in addition to that for evapotranspiration) to maintain salt balance in the root zone. Key factor in the procedure is the leaching efficiency, ranging from 0.2 for fine-textured soils to 0.6 for coarse-textured soils. Also taken into account are the salt tolerance of the crop, salt concentration of the irrigation water, and evapotranspiration. The procedure predicted accurately the known leaching requirements for salt balance of 3 irrigated regions. In defining irrigation efficiency, distinction is made between an efficiency of water utilization and an efficiency of water application. Drainage flow from the root zone decreases after irrigation. The water table response of a system of parallel drains to this flow can be computed for the design of a drainage system to avoid high water tables. (USBR)
W69-09544

TRANSIENT FUNCTIONS FOR LAND DRAINAGE,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 02F.
W69-09654

STANDS FOR AUTOMATION ACHIEVED BY SPRINKLING,
California Univ., Davis.
Frank E. Robinson.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR3, Pap 6774, p 385-389, Sept 1969. 5 p, 3 tab, 11 ref.

Descriptors: *Irrigation design, *Irrigation systems, *Sprinkler irrigation, Saline soils, Soil conservation, Water utilization, Automation.
Identifiers: *Sprinkler irrigation benefits, Agricultural automation.

Solid set sprinkler systems applying water at approximately 0.1 inch per hr showed improvement over conventional surface irrigation. By preventing surface salt accumulation, increasing crop emergence, saving water, maintaining soil tilth, increasing land use efficiency, and reducing labor requirements, sprinkler irrigation has become essential to the mechanization and automation of desert agriculture. (Knapp-USGS)
W69-09655

INDIANA AGRICULTURAL IRRIGATION IN 1967,
Indiana Dept. of Natur Resources, Indianapolis. Water Planning Section; and Purdue Univ., Lafayette, Ind. Agriculture Extension Service.
Kenneth Kemp, James O. Russell, Jerry V. Mannering, Dan Wiersma, and Donald R. Sisson.
Indiana Dep Natur Resources Irrig Rep, May 1969. 27 p, 1 fig, 4 tab, 7 ref, 3 append.

Descriptors: *Irrigation, *Indiana, *Consumptive use, *Surveys, *Data collections, Water utilization, Irrigation water, Water sources, Water supply, Irrigation practices, Water management (Applied).
Identifiers: Indiana irrigation.

A study was made to determine the irrigated area and amount of irrigation water used in Indiana. Irrigation is used in 90% of the counties in the State, and irrigation is the largest consumptive use of water in Indiana. The total irrigated area in 1967 was 30,373 acre-ft, on which 26,178 acre-ft of water was applied. The number of irrigators, irrigated acreage, type of irrigation, and water consumed are tabulated. (Knapp-USGS)
W69-09680

HUMBOLDT RIVER STUDIES,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 04B.
W69-09724

A COMPOSITE VARIABLE FOR ESTIMATING THE PRODUCTIVITY OF IRRIGATION WATER,
Hawaii Univ., Honolulu. Water Resources Research Center.
Howard C. Hogg, Jack R. Davidson, and Lloyd B. Rankine.
p 95-107 in Water Resources Research Center's bound volume of Collected Reprints, Vol I. Proceedings of the Committee on Economics of Water Resources Development of the Western Agricultural Economics Research Council, Dec 1967, Rpt No 16. p 25-35, 1968. 7 ref. OWRR Proj A-012-HI.

Descriptors: *Composite variable, *Water production function, *Water-balance function, Effective pan factor, Irrigation, Sugar cane, Effective rainfall, Potential evapotranspiration, Soil-moisture-storage, Actual evapotranspiration, Annual pan evaporation demand, Moisture stress.

A composite variable for estimating a water yield relationship was first developed then shown to work well in the case of sugar cane. The applicability of the procedure to other crops grown in other producing areas is undetermined. However, it appears promising for several other crops. The following data are required to estimate the variable: pan evaporation, rainfall, soil moisture storage, number of irrigation rounds, and the relationship between consumption use and pan evaporation for the crop being considered.
W69-09736

IRRIGATION COMPANIES.
Ark Stat Ann secs 35-1201 thru 35-1209 (1962).

Descriptors: *Irrigation programs, *Arkansas, *Irrigation, *Operation and maintenance, Eminent domain, Legal aspects, Condemnation, Irrigation canals, Irrigation ditches, Drains, Conveyance structures, Aqueducts, Dams, Water conveyance, Pipes, Structures, Compensation, Rivers, Lakes, Canal construction, Bridge construction, Bridges, Right-of-way, Easements, Legislation.
Identifiers: Corporations.

All corporations organized for the purpose of furnishing water to the public for irrigation of any lands or crops are authorized to exercise the right of eminent domain when necessary to accomplish such purpose. Such corporations may draw water from any river, lake, or creek when necessary and in general may do any act necessary or convenient in accomplishing the purpose of this act. Guidelines are set out for the surveying of contemplated lines of construction. When any irrigation company constructs its canals, ditches, conduits, aqueducts, pipelines, or any of its works across a public road, it is required to build a sufficient bridge across such obstruction. Water shall be supplied at equitable rates to the owners of all lands adjacent to any canal constructed or operated by any irrigation company. (Keith-Fla)
W69-09781

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

SANITARY AND DRAINAGE COMMISSIONS.

SC Code Ann secs 18-101 thru 18-110 (1962).

Descriptors: *South Carolina, *Drainage, *Drainage districts, *Drainage programs, Legislation, Administrative agencies, Cities, Political aspects, Public utilities, Drains, Canals, Ditches, Culverts, Roads, Engineers, Surveys, Maps, Condemnation, Adjudication procedure.
Identifiers: Counties, Agricultural drainage.

The Governor upon request of the senator and representatives of any county, may appoint members of the Sanitary and Drainage Commission for the county. The Commission shall function in sanitary drainage, public utility drainage and agricultural drainage. The duties and powers of every commission shall be to: (1) have control over drains; (2) make surveys; (3) make alterations, improvements and additions to drainage works; (4) compel drains to be kept in good order; (5) require persons to dig and open drains or ditches; (6) utilize the county chain gang; (7) do all work for drainage purposes; (8) prepare estimates; and (9) condemn lands. The commission may recover expenses (in an action brought in the court of common pleas) from any person who refused to comply with their order. Subsequent purchasers of land pending work by the commission shall be liable for expenses and charges paid or incurred by the commission. (Shevin-Fla)
W69-09458

A NOTE ON MORAN'S PROBABILITY THEORY OF DAMS AND STORAGE SYSTEMS,
City Univ., London (England).
C. Venetis.
Water Resources Res, Vol 5, No 3, p 884-887, Aug 1969. 4 p, 2 fig, 2 ref.

Descriptors: *Reservoir operation, *Water storage, *Reservoir yield, *Probability, Reservoir design, Streamflow forecasting.
Identifiers: Moran's theory (Reservoirs).

The distribution of the reservoir content is examined in discrete time and continuous state space for constant release. Empty and full reservoir probabilities are expressed by the Dirac delta function. The distribution of the reservoir content is obtained by convolution, taking into account the constraints in the range of variation of the content of the finite reservoir that may not meet the demand. The case of nonzero probabilities of zero inflows is briefly discussed, and the equations for the discrete case are derived from those of the continuous by substituting summations for the integrals. (Knapp-USGS)
W69-09470

SOME EFFECTS OF MAN-MADE CONTROLS IN THE UPPER REACHES OF A SMALL DRAINAGE BASIN,
Mississippi State Univ., State College. Dept. of Civil Engineering; and Mississippi State Univ., State College. Water Resources Research Inst.
Adnan Shindala, and Melville S. Priest.
Water Resources Bull, Vol 5, No 2, p 3-9, June 1969. 7 p, 5 fig, 1 ref. OWRR Proj A-023-MISS.

Descriptors: *Watershed management, *Flood control, *Reservoir operation, *Channel morphology, Width, Erosion, Floods, Streamflow, Cross-sections, Profiles, Peak discharge.
Identifiers: Watershed management effects.

Governmental agencies have been instrumental in the construction of numerous dams and other control structures in the small watersheds of the State of Mississippi. Although some of the consequences are predictable, there are some effects which are not yet well defined. The physical effects of such works on a particular stream and its channel are described. As was anticipated, peak discharges appear to have been somewhat reduced. Changes in channel cross-section depend, to some extent, upon location along the stream. However, there appears to have been a narrowing of the channel in that portion of the stream for which cross-sections were available. (Knapp-USGS)
W69-09491

FLOOD PLAIN INFORMATION, EAST FORK WHITE RIVER AND TRIBUTARIES, VICINITY OF COLUMBUS, INDIANA.
Corps of Engineers, Louisville, Ky.

Corps Eng Flood Plain Rep, Dec 1968. 45 p, 9 fig, 21 plate, 14 tab.

Descriptors: *Floods, *Flood damage, *Indiana, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Columbus (Indiana), White River, Standard project flood, Intermediate regional flood.

Flooding of the East Fork White River, Columbus, Indiana is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-09496

FLOOD PLAIN INFORMATION-COASTAL FLOODING AT HAMPTON, VIRGINIA.
Corps of Engineers, Norfolk, Va.

Corps Eng Flood Plain Rep, Oct 1968. 31 p, 5 fig, 6 plate, 2 tab.

Descriptors: *Floods, *Flood damage, *Virginia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Hampton (Va), Standard project flood, Intermediate regional flood.

Flooding of the Hampton, Virginia coastal area is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-09497

WATER LAW--THE RISE AND FALL OF NEW MEXICO'S TEMPLETON DOCTRINE,
For primary bibliographic entry see Field 06E.
W69-09562

RIVERS AND CREEKS.
For primary bibliographic entry see Field 06E.
W69-09585

BRINKLEY V EATON (RESPONSIBILITY FOR NATURAL ALTERATION OF FLOW).
For primary bibliographic entry see Field 06E.
W69-09586

WATER AND SEWERS.
For primary bibliographic entry see Field 06E.
W69-09589

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09590

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09591

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09592

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09593

DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09594

SOIL CONSERVATION DISTRICTS PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09603

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09604

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09605

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09606

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09607

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09608

MUNICIPAL AND COUNTY GOVERNMENT (WATER WORKS).
For primary bibliographic entry see Field 06E.
W69-09617

WATER SUPPLY FACILITIES; FLOOD CONTROL; WATER MANAGEMENT.
For primary bibliographic entry see Field 06E.
W69-09619

CANALS AND WATERWAYS.
For primary bibliographic entry see Field 06E.
W69-09620

CHICAGO REGIONAL PORT DISTRICT.
For primary bibliographic entry see Field 06E.
W69-09621

REGULATING AND MEASURING WATER-POWER.
For primary bibliographic entry see Field 06E.
W69-09623

CONTRACTS BY CITIES WITH UNITED STATES REGARDING FLOOD CONTROL PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09627

INTERSTATE DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09628

DRAINAGE DISTRICTS IN CONNECTION WITH UNITED STATES LEVEES.
For primary bibliographic entry see Field 06E.
W69-09629

TRUSTEE MANAGEMENT OF DRAINAGE OR LEVEE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09630

LEVEE AND DRAINAGE DISTRICTS.
For primary bibliographic entry see Field 06E.
W69-09632

CONSTRUCTION AND MAINTENANCE OF BRIDGES AND CULVERTS.
For primary bibliographic entry see Field 06E.
W69-09635

WATER-POWER IMPROVEMENTS.
For primary bibliographic entry see Field 06E.
W69-09638

ADMINISTRATION - HIGHWAYS - DRAINAGE.
For primary bibliographic entry see Field 06E.
W69-09639

INTERSTATE BRIDGES (ADDITIONAL ACT).
For primary bibliographic entry see Field 06E.
W69-09644

EXERCISE OF EMINENT DOMAIN BY CITIES FOR CONSTRUCTION OF WATERWORKS AND WATER PIPE LINES.
For primary bibliographic entry see Field 06E.
W69-09645

FLOODS ALONG LITTLE CALUMET RIVER AND TRIBUTARIES, ILLINOIS AND INDIANA.
Corps of Engineers, Chicago, Ill.

Corps Eng Flood Plain Inform Brochure, 1969. 1 sheet, text, 6 fig, 14 photo, 2 map.

Descriptors: *Floods, *Flood damage, *Illinois, *Indiana, Floodplains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Little Calumet River (Ill-Ind), Standard project flood, Intermediate regional flood.

Flooding of the Little Calumet River, Illinois and Indiana is described in a report of floodplain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections in a 1-sheet flood potential report indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of floodplain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-09689

SOME CHARACTERISTICS OF VEGETATION DEVELOPMENT IN THE FLOODPLAIN OF OB RIVER IN THE TAIGA ZONE (RUSSIAN),
Leningrad State Univ. (USSR).
For primary bibliographic entry see Field 02I.
W69-09700

CONTROL OF TEMPERATURES OF WATER DISCHARGED FROM A MULTIPLE-PURPOSE RESERVOIR,
Corps of Engineers, Vicksburg, Miss.
J. B. Middleton.
Reservoir Fish Resources Symp, Georgia Univ, Apr 5-7, 1967, p 37-46, 1967. 10 p, 5 fig.

Descriptors: *Temperature control, *Reservoir design, Multiple-purpose reservoirs, *Reservoir operation, *Stream fisheries, Reservoir construction, Water temperature, Intake structures.
Identifiers: Stream fisheries conservation.

The control of temperatures of water discharged from multiple-purpose reservoirs is now accepted as one of the goals of the reservoir planner in those cases where this is necessary to avoid damage to downstream fisheries. The planning and design of DeGray Reservoir on the Caddo River in south-central Arkansas was coordinated with interested agencies from the earliest stages. From this planning has evolved a design of an intake structure which may be utilized to control, within a wide range, the elevations from which discharges are withdrawn. This feature, together with a downstream regulating dam, is expected to make practical the preservation of the existing downstream fishery. (Carstea-USGS)
W69-09706

OPERATIONAL PROBLEMS ASSOCIATED WITH A BASIN RESERVOIR SYSTEM,
Corps of Engineers, Omaha, Nebr. Missouri River Div.
Donald C. Bondurant, and Robert H. Livesey.
Reservoir Fish Resources Symp, Georgia Univ, April 5-7, 1967, p 47-55, 1967. 9 p, 1 fig, 2 tab.

Descriptors: *Reservoir operation, *Missouri River, *Water management (Applied), *Water resources, Watershed management, Irrigation, Reservoir storage, Navigation, Flood control, Water supply, Hydroelectric power, Reservoir fisheries.
Identifiers: *Missouri River reservoir system.

Most operational reservoirs in the United States have no specific provisions for fish and wildlife conservation. However, the operation of the existing reservoirs can be such as to improve fish and wildlife and recreational benefits. The 6 major reservoirs on the Missouri River are primarily designed for flood control, irrigation, hydroelectric power and navigation. The main decision-making steps to best accommodate as many interests as possible are described. Research studies were undertaken at Gavins Point and Oahe to learn more about the characteristics of fish reproduction as a function of hydrologic environment. (Carstea-USGS)
W69-09707

TRACING STORM AND BASE FLOW TO VARIABLE SOURCE AREAS ON FORESTED HEADWATERS,
Georgia Univ., Athens. School of Forest Resources.
John D. Hewlett.
School of Forest Resources, University of Georgia, Athens, Georgia, Aug 1969. 21 p, 7 ref. OWRR Project A-004-GA.

Descriptors: *Base flow, *Surface-groundwater relationships, *Soil moisture content, *Forest soils, *Interfluves, *Aquifers, *Groundwater movement, *Groundwater recharge, Runoff forecasting, Percolating waters, Surface waters, Groundwater basins, Streamflow, Watersheds, Infiltration, Distribution patterns, Hydrogeology, Organic waste matter, Georgia, Southeast U.S.
Identifiers: Piedmont Province, Variable source areas, Sherman-Hortonian unit hydrograph.

Objectives of the project were to apply the variable source area concept of headwater hydrology to replacement of the Sherman-Hortonian theories of runoff; to measure the organic and inorganic debris product by a forested catchment and to trace this debris to its source; to provide a teaching aid to improve the instruction of student land managers; and to secure a few years of high-quality precipitation and streamflow data from a forested Piedmont Province watershed. Fifty-five storm hydrographs, together with detailed observations on rainfall, soil moisture and groundwater levels, were analyzed in the light of the variable source area concept for a 60-acre forested watershed in the Piedmont Province in Georgia. Behavior of streamflow as hypothesized by the variable source area concept and as verified by measured changes in soil water content with depth and along the slope is summarized on a cross-section through a headwater stream. The variable source area provides all of the storm flow and much of the base flow between storms, and the main aquifer under the interfluve, provides a relatively stable portion of base flow. Methodology and evaluation of the findings are contained in an MA thesis by William P. Neal entitled, 'The Southern Piedmont Upland of the Southeastern United States: A Geomorphic System in a Steady State of Dynamic Equilibrium', and a PhD dissertation by Wilhelm G. Tischendorf entitled, 'Tracing Stormflow to Variable Source Areas in a Small Forested Watershed in the Southeastern Piedmont'. (Conway-Ga Inst of Tech)
W69-09720

TRACING STORMFLOW TO VARYING SOURCE AREAS IN A SMALL, FORESTED WATERSHED IN THE SOUTHEASTERN PIEDMONT,
Georgia Univ., Athens. School of Forest Resources.
Wilhelm G. Tischendorf.
Ph.D. Thesis, Univ of Ga, 1969. 114 p.

Descriptors: *Water sources, *Storm runoff, *Subsurface runoff, Soil water movement.
Identifiers: Variable source area.

The existence and areal extent of subsurface stormflow was studied on a 60-acre forested watershed in the Georgia Piedmont. Between January 1967 and March 1968, 14,519 moisture readings were obtained from 42 sites on the watershed. To a maximum depth of 20 feet below the soil surface. Hydrographs were separated into stormflow and baseflow by a standardized slope of 0.05 csm/hr. From 55 rain storms during the study period, 36 had stormflow volumes equal to channel precipitation, with no evidence of overland flow. Stormflow and channel expansion sometimes continued after rainfall had ended. During larger storms, lateral subsurface flow caused a rapid rise of the groundwater table only in the vicinity of the perennial spring heads. Elsewhere the groundwater table, at depths greater than 30 feet, showed only seasonal fluctuations up to 3 feet with maximum levels in July. The annual moisture cycle in the soil expressed itself as a sine curve down to 20 feet depth. Maximum moisture constant was reached in March in the top 3 feet, and in June at 12 feet in the soil mantle. The upper 3 feet showed the most immediate response to rainfall. Soil moisture concentrations below 3 feet lagged in their response. At 12 feet this lag was 3 months. Rapid vertical flow of moisture cannot be assumed under such conditions. Increase in moisture after rain in the upper 3 feet of soil was greater as distance from the channel increased indicating that rain was stored upslope but released down slope. With lack of rapid vertical percolation downward through the soil mantle, water must have drained laterally from the lower sections of the slope. Therefore, contribution of subsurface flow to direct runoff decreased with distance from the channel, and was detectable by periodic soil moisture measurement only in the upper 3 feet of the soil mantle. Direct runoff volumes from the seven largest storms varied from 9 to 30 per cent of gross precipitation; the average percentage from all storms was 8 per cent of gross precipitation. The study was a unique analysis of the variability of the source area for stormflow on an entire watershed, proving that the variable source area concept is a valid representation of the rainfall-runoff relation.
W69-09740

BALTIMORE'S WATERSHEDS: AN EXAMPLE OF INTEGRATED LAND USE,
Forest Service (USDA), Washington, D.C. Div. of Watershed, Recreation, and Range Research; and Bureau of Water Supply, Baltimore, Md.
For primary bibliographic entry see Field 04C.
W69-09761

PILOT PLANNING STUDY FOR AREA WIDE STORM DRAINAGE PLANNING.
Wright-McLaughlin Engineers, Denver, Colo.

Pilot Planning Study for Area Wide Storm Drainage Planning, Volume II, April 1969. 76 p, 3 fig, 14 tab.

Descriptors: *Planning, *Water management (Applied), *Flood control, *Drainage, Drainage systems, Flood plain zoning, Methodology, Estimated costs, Legal aspects, Multiple-purpose projects, Regional analysis, Hydrograph analysis, Unit hydrograph, Detention reservoirs, Channels, Conduits.
Identifiers: *Boulder (Colo), *North Boulder (Colo), *Environmental design.

This pilot planning study includes the development of a methodology for the preparation of an area wide storm drainage plan, a study of alternate solutions to the North Boulder, Colorado major drainage problems, preparation of storm drainage master plans for five North Boulder waterways, development of a financing strategy and a practical test of the recently completed Urban Storm Drainage Criteria Manual. North Boulder was chosen as a pilot study because it represented most of the urban drainage problems found in the Denver region and because it had no flood plain management program, policy, or regulation ordinances. The problem was defined hydrologically and hydraulically by field and office studies to develop all practical alternates and to study these alternates using a qualified environmental design team approach. Economics, comprehensive plans and programs of the city and county, open space needs, greenbelt requirements, and legal aspects of urban storm drainage were all taken into consideration when evaluating alternates. A detailed discussion of the Colorado Urban Hydrograph Procedure, which was used in determining flood magnitudes was given. The report is contained in two volumes: Volume one contains the text of the report and Volume two contains thirty detailed drawings of the proposed Wonderland Creek Drainage. (Marriott-Chicago)
W69-09774

CUTTING TIMBER ON SWAMPS AND OVERFLOWED LANDS.

Ark Stat Ann sec 10-301 (1956).

Descriptors: *Arkansas, *Lumbering, *Swamps, *Forest management, Lumber, Legislation, Legal aspects, Federal government.
Identifiers: Penalties (Criminal).

It is unlawful to cut, destroy or remove any timber standing on any of the swamp and overflowed lands granted by Congress to the state. Criminal penalties are provided for violation of the foregoing provision. Any person who resides on such swamp or overflowed lands may cut timber growing on the tract which he occupies for his own use for building or farming purposes. (Keith-Fla)
W69-09778

SALE OF SWAMP AND OVERFLOWED LANDS.

Ark Stat Ann 10-801 thru 10-807 (1956).

Descriptors: *Arkansas, *Swamps, Legislation, Legal aspects, Wetlands, Appraisals, Administrative agencies, Federal government, Adoption of practices, Boundaries (Property), Beds.
Identifiers: *Overflowed lands.

The commissioner of state lands is authorized to sell lands granted by Congress to the state under the designation 'Swamp and Overflowed Lands.' On application to purchase any such lands, the commissioner will determine whether or not the land is wild and unimproved. If the land is found to be wild and unimproved, then it will be appraised. The method for price determination of such land is specified for different classes of purchasers. It is provided that money from sales be credited to the swamp land fund. Provision is made for the handling of conflicting claims. (Keith-Fla)
W69-09779

AUTHORITY OF CITIES TO OPERATE HARBORS AND PORTS; CREATION OF PORT AUTHORITIES.

Ark Stat Ann secs 19-2701 thru 19-2748 (1968).

Descriptors: *Arkansas, *Port authorities, *Administration, *Structures, Legislation, Legal aspects, Cities, Harbors, Eminent domain, Condemnation, Financing, Right-of-way, Bridges, Multiple-purpose projects, Administrative agencies, Levees, Docks, Piers, Construction, Maintenance, Navigation.
Identifiers: Riparian terminals.

Cities are authorized to establish, construct, and regulate landing places, levees, wharves, docks, piers, and basins for the proper regulation of the navigation, trade, or commerce of such city. Cities may also purchase, construct, and operate any ports, harbors, river-rail terminals, barge terminals, or any other structures convenient to the carrying on of commerce. Cities may create port authorities to carry out the foregoing powers. Any of the foregoing structures or property for the construction thereof may be acquired by the city through exercise of the power of eminent domain. Specific provisions indicate how the acquisition or construction of any of the foregoing structures is to be financed. The general purposes for which port authorities may be created are enumerated as are the powers of such authorities. Any combination of cities and counties in or out of the state may exercise the foregoing powers for the purposes aforementioned. Special methods of financing are provided for such joint efforts. (Keith-Fla)
W69-09780

DAMAGE TO WATER, FLOOD CONTROL STRUCTURES, OR FISH.
For primary bibliographic entry see Field 05G.
W69-09782

HIGHWAYS.

Ark Stat Ann sec 76-1518 (1958).

Descriptors: *Arkansas, *Bridge construction, *Navigable rivers, *Administrative agencies, Streams, Legislation, Highways, Local governments, Bridges.

When any county is to build a highway bridge across a navigable stream which is over four hundred feet in width, it shall be the duty of the County Court to appoint a commission of two competent property holders and taxpayers of said county, who in conjunction with the County Judge shall constitute a Board of Commissioners. The Board's duty shall be to locate said bridge and to give notice by publication of readiness to receive plans, specifications, and bids for the erection of said bridge. (Marsee-Fla)
W69-09783

CROSSING BY STATE HIGHWAYS OF WATERCOURSES.
Del Code Ann tit 17, sec 707 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Navigable waters, *Highways, *Navigation, Administrative agencies, Roads, Civil engineering, Road construction, Highway relocation, Transportation, Right-of-way, Railroads, Rivers, Streams, Canals, Legislation, Surveys.

The State Highway Department may cross any canal, navigable stream or watercourse with a state highway but only in such a manner as to not unnecessarily impede the navigation and use thereof. The Department may enter upon the land or waters of any person to make any surveys for the proposed highways. (Helwig-Fla)
W69-09788

STAUFFACHER V CITY OF SUN PRAIRIE (RIGHTS TO A DRAINAGE EASEMENT).
168 NW 2d 587-588 (Wis 1969).

Descriptors: *Wisconsin, *Drainage, *Easements, *Assessments, Legal aspects, Judicial decisions, Storm drains, Cities, Ditches, Drainage water, Sewers, Contracts, Damages, Construction, Construction costs, Maintenance, Maintenance costs, Operation and maintenance, Local government, Water conveyance, Waste water disposal.
Identifiers: Injunction (Prohibitory).

Plaintiff's predecessors in title made an agreement with the defendant concerning a drainage easement. Plaintiff alleged that the easement was granted upon the condition that the defendant would not assess the landholders or their heirs or assigns, the plaintiffs, for any improvements made

to the drainage ditch. The defendant assessed plaintiff's land for sewer construction and plaintiff sought injunctive relief. The trial court dismissed the complaint holding that the covenant only prohibited an assessment for a ditch and not one for a sewer and thus had not been violated by defendant. The trial court also held that the defendant had no power to acquire an easement for public purposes by freeing the abutting land from an assessment for the construction of the easement. On appeal the court agreed with the trial court's determination that the easement was for a drainage ditch and not a sewer line. However, they disagreed with the lower court's conclusion respecting the defendant's ability to acquire the easement and reversed the judgment with leave for plaintiffs to amend. (Shevin-Fla)
W69-09790

RIVER FRONT IMPROVEMENT COMMISSION.

Iowa Code Ann secs 372.1-372.17 (1949), as amended, (Supp 1969), sec 372.18 (Supp 1969).

Descriptors: *Administrative agencies, *Rivers, *Planning, *Iowa, Wharves, Riparian rights, River beds, City planning, Dams, Construction, Legislation, Meanders, Streams, Taxes, Financing, Beds, Ownership of beds, Regulation, Flood control, Water resources development, River regulation, Dams, Cities.
Identifiers: *Title, *Improvements.

Five hundred electors in certain specified classes of cities may petition the governor to appoint a river-front improvement commission. Title to streams shall vest in the commission to the extent that such streams border on or are included within the city. Title to the beds of these streams remains in the state, and riparian rights are not effected. Title to non-meandered streams may be acquired by purchase or condemnation. The commission may: redeem lands between meandered lines or lands in the channel of any stream that is not meandered; construct, regulate and maintain dams; and provide for a channel adequate to carry flood waters. The commission may adopt plans: for the improvement of such river channel and banks; reclaiming of land; and the construction of dams. The commission may acquire real estate and riparian rights. Bonds may be issued to finance such purchases. Regulations or ordinances may be prescribed for the government of such public grounds. (Darragh-Fla)
W69-09792

ASPECTS OF STATE STATUTES II,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W69-09798

ZABEL V TABB (PERMIT TO DREDGE AND FILL IN NAVIGABLE WATERS).

296 F Supp 764-771 (MD Fla 1969).

Descriptors: *Florida, *Landfills, *Rivers and Harbors Act, *Navigation, Dredging, Navigable waters, Submerged lands, Ownership of beds, Channels, Bridges, Administrative agencies, Conservation, Bays, Beach erosion, Floods, Wildlife, Ecology, Harbors, Federal government, Permits, Legislation, Culverts, Judicial decisions, Legal aspects, Administrative decisions.
Identifiers: Obstruction to navigation, Intracoastal waterways, Corp of engineers.

The plaintiffs applied for a permit under the Rivers and Harbors Act to dredge and fill in navigable waters. Their application was denied and plaintiffs sought judicial relief. Title to the submerged land rested in the plaintiffs and they obtained consent to do the work from all local agencies concerned. The facts showed that the work would have no detrimental effect on navigation. No effect would be rendered on erosion or flood heights, but the secretary found there would be a detrimental effect to wildlife and denied the petition. The court acknowledged that it could not overturn the decision of an administrative agency unless it was contrary to law as not within the discretion of the agency. The court stated that the act only gave defendants authority to refuse a permit when there would be a detrimental effect to navigation. Defendants contended that they should be able to apply the Fish and Wildlife Coordination Act and deny the permit for reasons other than navigation. The court held that the legislation did not give the defendants the authority to deny a permit for dredge and fill where they had factually determined that the proposed construction would not interfere with navigation. The court decided that it had jurisdiction to grant the plaintiffs relief. (Shevin-Fla)
W69-09802

DUTIES AND POWERS OF STATE HIGHWAY DEPARTMENT.

SC Code Ann secs 33-71, 33-73, 33-81 (1962).

Descriptors: *South Carolina, *Highways, *Bridges, *Drainage, Administrative agencies, Road construction, Canals, Drainage canals, Culverts, Ditches, Embankments, Wharves, State governments, Legislation, Transportation.

The powers and duties of the State Highway Department include building and maintaining public highways and bridges and acquiring land needed for such highways and bridges. The Department may bring suit for injury to any road, bridge, culvert, ditch, causeway, embankment, wharf, or other facility belonging to the state. The Department may cooperate with any drainage district in order to carry drainage canals across state highways. (Helwig-Fla)
W69-09805

DRAINAGE OF LAND ADJACENT PUBLIC ROADS.
Del Code Ann tit 17, secs 901-904 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Highways, *Drainage, *Ditches, Conduits, Legislation, Flooding, Standing waters, Riddance (Legal aspects), Right-of-way, Surface runoff, Road construction, Drainage water, Embankments, Paving, Contours, Flow control, Topography.
Identifiers: Natural drainage.

The State Highway Department shall drain by suitable means waters which have backed upon lands along the right-of-way of any road caused by the changing of the natural contour lines whereby the natural drainage is retarded. The Department shall cause suitable ditches or conduits to be constructed along any highway so constructed as to cause water to collect on adjacent land. The Department may enter an agreement with any ditch company to clean drainage ditches along any highway. (Helwig-Fla)
W69-09813

PORTS AND MARITIME MATTERS.

SC Code Ann secs 54-1 thru 54-64 (1962).

Descriptors: *South Carolina, *Port authority, *Regulation, *Administrative agencies, State governments, Federal government, State jurisdiction, Ports, Harbors, Seaports, Watercraft, Transportation, Bridges, Causeways, Water policy, Water planning, Loans, Principal, Interest.
Identifiers: *Penalties (Civil).

The South Carolina State Port Authority is created to promote, develop, construct, and maintain the state harbors and seaports. The Authority has the powers of a corporate body. It may acquire and dispose of real and personal property, acquire, maintain, equip, and operate wharves, docks, ships, piers, and other facilities required in commerce, including airports, naval and seaplane bases and any other facility necessary to carry out the purposes of the Authority. The Authority has general supervision of all wharves, warehouses, and terminal facilities in Charleston and examines them with reference to the security and accommodation of the public and compliance with all applicable provisions of the law. The Authority may fix the lines along the bay and harbor of Charleston and the rivers and creeks flowing therein within which riparian owners may erect wharves, docks, and other proper erections and fixtures for commercial, manufacturing, or any other purposes. The Authority may issue bonds, payable both as to principal and interest from revenue derived from the operation of its properties and facilities. (Moulder-Fla)
W69-09816

CITY OF COON RAPIDS V SUBURBAN ENGINEERING INC. (FAILURE TO MEET SPECIFICATIONS FOR A DRAINAGE SYSTEM).

167 NW 2d 493-497 (Minn 1969).

Descriptors: *Minnesota, *Storm drains, Sewers, Closed conduits, Pipes, Drainage, Local governments, Cities, Judicial decisions, Damages, Remedies, Legal aspects, Specifications, Maintenance, Repairing, Drainage systems.

Before defendants could carry out plans to develop and sell land to the public within plaintiff city, it was necessary to install an adequate storm sewer system. Plaintiff agreed that if defendants would install a sewer system according to certain specifications, the city would accept it and bear the expense of future maintenance. The sewer system was installed and defendants assured plaintiff that the specifications had been fulfilled. There was some question as to whether the plaintiff in accepting the sewer system relied on this representation or on the report of their own engineer who apparently only made a cursory insepction of the system. Some time later, after continued repairs, plaintiff discovered the sewer was not built according to specifications and filed a suit for damages. The lower court, being of the opinion that the statute of limitations had run and that claims of fraud were merely attempts to disguise the true cause of action, granted defendants motion for summary judgment. Plaintiff appealed and the court reversed and remanded the case holding that there was sufficient evidence of fraud to preclude a summary judgment. (Gabrielson-Fla)
W69-09817

EXTENSION OF BOULEVARD OVER PUBLIC WATER WAYS.
Ill Ann Stat ch 105, secs 125 thru 129 (Smith-Hurd 1952).

Descriptors: *Illinois, *Administrative agencies, *Water policy, *Construction, Navigation, Legal aspects, Water law, Ownership of beds, Administration, Projects, Legislation, Riparian rights, Parks, Land use, Navigable waters, Relative rights, Riparian land, Water utilization, Beds under water, Roads, Road construction.
Identifiers: Boulevard extension, Public waters.

Every board of park commissioners has authority to extend any boulevard or driveway which borders any public waters of the state up to two hundred feet over and upon the bed of such waters provided that commercial navigation is not damaged thereby. Consent of at least two-thirds of the owners abutting such waters for such project, consent of the supervisor and assessor corporate authorities of the town wherein the proposed extension lies, and presentation of a plan containing an estimate of the cost of such project are prerequisite to construction of such an extension. The board may acquire riparian rights from

abutting land owners. The board has title to such submerged lands as are included between the shore of such public waters and the inner line of the extension of such boulevard or driveway and may convey title to such submerged lands for the purpose of defraying the cost of such extension. Extensions and the beds thereunder owned by the board are to be maintained and controlled by the board in the manner provided by law for the government and maintenance of other boulevards and driveways. (Johnson-Fla)
W69-09818

NAVIGATION AND WATERS (VESSELS).

Vt Stat Ann tit 25, secs 1-3, 41-45, 81-83 (1959).

Descriptors: *Vermont, Legislation, *Regulation, *Recreation, *Water sports, Boats, Boating, Use of water, Sailing, Natural use, Non-consumptive use, Transportation, Navigation, Navigable waters, Water allocation (Policy), Regulations, Safety, Swimming, Boating.
Identifiers: Little Lake St. Catherine, Lake Champlain, Boatable water, Big Lake St. Catherine, Lake Bomoseen, Rutland County.

No person shall operate any motorboat or vessel in a careless or negligent manner. In the event of death resulting from the careless or negligent operation of a boat or vessel, the punishment shall not exceed five years or more than two thousand dollars or both. Additional restrictive safety regulations concerning mufflers and speed are imposed. The state board of forests and parks is empowered to make rules and regulations concerning the designation of restricted swimming areas in any boatable waters located within the state. The master in charge of a vessel not carrying freight or passengers for hire shall show one good and sufficient light in some conspicuous place, near the bow. Vessels on Lake Champlain within Vermont shall carry and show such lights. (Moulder-Fla)
W69-09819

RIVERS AND STREAMS (GENERAL PROVISIONS).

Vt Stat Ann tit 25, secs 141-146 (1959).

Descriptors: *Vermont, *Rivers, *Streams, *Obstruction to flow, Legislation, Regulation, Easements, Relocation, Channels, Beds, Channel improvement, Floodways, Diversion structures, Flood control, Lakes, Ponds, Prescriptive rights.
Identifiers: *Channel restoration, Floodwood, Flowage, Adverse possession.

A public easement in a stream shall not be lost or abridged by prescription or adverse possession. The channel of a non-navigable river or stream which becomes changed, may be restored by the persons through whose land it formerly flowed. When obstructions change or prevent the even flow of water between the main banks of a stream, the property owner may apply to the town selectmen for authorization to remove the obstruction at his own expense. In the case of negligent deposits of sand, gravel, debris, floodwood, or rubbish by a person other than the property owner, a petition specifying the negligent person may be offered to the town selectmen for action. When a person considers himself injured by the action of the selectmen, he may apply to the court of chancery for relief. All land which may be flowed by damming, taking, storing, or diverting the waters of any stream, river, lake, or pond by a corporation or association existing under charter or authority of the state shall, prior to the flowing, be cleared of trees and bushes. (Moulder-Fla)
W69-09820

NAVIGATION AND WATERS.

Vt Stat Ann tit 25, secs 201-207, 241-246 (1959).

Descriptors: *Vermont, *Logging, *Lumbering, *Obstruction to flow, Legislation, Regulation, Lumber, Timber, Streams, Banks, Non-consumptive use, Riparian rights, Water utilization, Properties, Damages.
Identifiers: Penalties (Civil).

General provisions cover the anchoring of log booms on land bounding upon the river or stream down which logs are run. Lodged lumber not taken away by the owner before May 1, may be retained by the landowner until he is paid for damages suffered. If the lumber is not removed by November 1, the landowner may take the lumber and convert it to his own use; however, he must first advertise the lumber in the town where the lumber is lodged. When the landowner and lumber owner cannot agree upon damages, the town selectmen shall make a final adjustment. In the case of damage by floating lumber, either party may also prefer a petition to the public service commission, which shall determine the cause of property damage. The county court shall render judgment. Foreign corporations must post bond before floating lumber down the rivers and streams of the state. Penalties for violations of these provisions are provided. (Moulder-Fla)
W69-09821

FLOOD CONTROL.

Ark Stat Ann sec 17-315 (1968).

Descriptors: *Arkansas, *Flood control, *Flood protection, *Eminent domain, Water management (Applied), Control structures, Check structures, Levees, Reservoirs, Easements, Legal aspects, Legislation, Condemnation, United States, Local governments, Construction.

The county governments of the state may enter upon and take lands, or easements on lands, by purchase, grant, donation, devise or eminent domain for the purpose of locating, constructing and managing floodways, reservoirs, spillways, levees, or other flood control improvements. If eminent domain must be exercised to acquire lands or interests therein, the county government shall proceed as provided by statute. Nothing in this act shall be construed to relieve the United States of any responsibility or liability which it has assumed by the federal flood control acts. (Kelly-Fla)
W69-09823

ACQUISITION OF UTILITIES AND RECLAMATION OF PREVIOUSLY SUBMERGED LAND BY CITIES.
Ill Ann Stat ch 24, secs 11-123-1 thru 11-123-7, 11-123-10, 11-123-20, 11-123-21, 11-123-22, 11-123-24 (Smith-Hurd 1960) as amended (Supp 1969).

Descriptors: *Illinois, *Land reclamation, *Ownership of beds, *Utilities, Cities, Waterworks, Public utilities, Legislation, Condemnation, Rivers, Levees, Canals, Docks, Piers, Harbors, Breakwaters, Channels, Right-of-way, Land forming, Accretion (Legal aspects), Water utilization, Beds, Administration, Reclamation.
Identifiers: Public waters, Harbor development, Harbor structures.

The term 'utility' is defined as including harbors, canals, slips, wharves, docks, levees, piers, quay walls, breakwaters, and all appropriate harbor structures. The term 'artificially made or reclaimed land' is defined to include all land which formerly was submerged under the public waters of the state, the title to which is in the state, and which has been artificially made or reclaimed, in whole or in part, contrary to law. Any city may acquire utilities by purchase, condemnation, or otherwise and may operate utilities located within its jurisdiction or in, over, and upon public waters bordering thereon. Specific provisions for reclamation by a city of specified submerged land and artificially made land are made to enable the city to operate utilities. Accretions or artificially made or reclaimed land which are formed or added to any utility constructed under the foregoing authority become the property of the city. A city is empowered to condemn any land or right-of-way for the purpose of widening, deepening, or otherwise improving a river or harbor. (Keith-Fla)
W69-09824

WATER SUPPLY, DRAINAGE FLOOD CONTROL.

Ill Ann Stat ch 34, secs 3115-3123 (Smith-Hurd 1960), as amended, (Supp 1969).

Descriptors: *Illinois, *Water supply, *Sewage, *Flood control, United States, State governments, Local governments, Water pollution, Financing, Waterworks, Maintenance, Planning, Treatment facilities, Pollution abatement, Regulation, Water resources.

The county board may cooperate with federal agencies, municipalities, and political subdivisions of this state for planning, construction and improvement of flood control, water supply and sewage facilities. The board has authority to prevent water pollution and to cause any person, party or corporation to halt activities resulting in pollution. Bonds may be issued for financing and are to be paid off by use of revenues from waterworks or sewage treatment facilities. Rates for use shall be sufficient to provide funds for the maintenance and depreciation of facilities and for the payment of the principal and interest on bonds. Rules and regulations for use are promulgated by ordinance. (Darragh-Fla)
W69-09825

INDIVIDUAL DRAINAGE RIGHTS.
Iowa Code Ann, secs 465.1 to 465.29 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Drainage, *Surface drainage, *Subsurface drainage, Legislation, Ditches, Tile drainage, Mine drainage, Obstruction to flow, Damages, Legal aspects, Levees, Railroads, Highways, Controlled drainage, Compensation, Local governments, Natural flow, Discharge (Water), Drains, Boundaries (Property).
Identifiers: Individual drainage rights.

Landowners desiring to construct any levee, open ditch, tile, or underground drain, for agricultural, mining, or improved drainage purposes across the lands of others or the right of way of a railroad or highway may file an application with the township clerk setting forth the description of the land and the specifications for such levee, ditch, or drain. The township trustees shall then conduct a hearing to determine the desirability of such system, the permissible specifications therefor, and the compensation to be paid by the applicants for property damages by reason of the construction. Where such construction is through railroad property, the railroad company may choose to construct such improvement. Any dispute as to the repair of a constructed drain shall be determined by the trustees. Any person obstructing such drain shall be liable to the owner of the drained lands for damages caused thereto. Landowners may drain their land in the general course of natural drainage by constructing or reconstructing, wholly upon their own land, open or covered drains, discharging the same in any natural watercourse or depression, and shall not be liable in damages therefor. (Marsee-Fla)
W69-09826

DRAINAGE AND LEVEE DISTRICTS WITH PUMPING STATIONS.

Iowa Code Ann, secs 461.1 to 461.24 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Pumping plants, *Drainage systems, Drainage programs, Surface waters, Drainage engineering, Drainage practices, Chan-

neling, Controlled drainage, Pumps, Watersheds (Basins), Water conveyance, Legislation, Legal aspects, Levees, Regulation, Administrative agencies, Costs, Construction costs, Assessments.

In counties where a drainage district has been established, the Board of County Supervisors may establish and maintain pumping stations if these are necessary for proper drainage of the land comprising the district. The costs of construction and maintenance of a pumping station may be assessed against lands in the district which are thereby benefited. The county board may act to establish a station only upon petition by one-third of the affected landowners. The lands benefited by such a station will be determined by the board and by report of an engineer appointed by the board of supervisors. After the establishment of a drainage district and pumping plan, but before completion of the improvement, the board may resolve to establish such additional pumping stations as the engineer may recommend. The board must consider petitions by landowners for additional pumping stations. The board, upon receipt of the proper petition from the landowners, may act to divide a drainage district in which two or more pumping stations are operating. A county board may acquire lands for a channel running from overflowed lands to a settling basin if flooded conditions exist in its district, and if a basin has been provided. (Kelly-Fla)
W69-09827

IOWA NATURAL RESOURCES COUNCIL.
For primary bibliographic entry see Field 06B.
W69-09828

FEDERAL FLOOD CONTROL COORDINATION.
Iowa Code Ann, secs 455.201 to 455.217 (1949), as amended, (Supp 1969).

Descriptors: *Flood control, *Iowa, *Drainage districts, *Administrative agencies, Coordination, Engineering estimates, Damages, Benefits, Conservation, Local governments, Financing, Legislation, Construction costs, Cost allocation, Appraisals, Assessments, Meanders, Streams, Levees, Federal government.

Whenever the United States government files a plan for improvements to a water district with the county auditor, the board of supervisors of the county has authority, after notice and hearing, to accept said plan and pay that portion of the expenses not paid by the federal government. No notice or hearing is necessary where the plan's cost does not exceed 25% of the total previous district expenditures. After the plan is filed, an engineer is appointed to examine the plan and report to the board. If the report is favorable and the board accepts the plan, then appraisers are appointed to determine damages and commissions are appointed to assess benefits derived. If the district is managed by a board of trustees, they will perform the functions of the board of supervisors. Any levee or drainage district may use, as a permanent easement, lands owned by the state upon permission from the appropriate state agency. (Darragh-Fla)
W69-09829

BRIDGES OVER NAVIGABLE RIVERS.
Ill Ann Stat ch 121, secs 192, 193a (Smith-Hurd 1960).

Descriptors: *Illinois, *Navigable rivers, *Bridges, *Bridge construction, Piers, Legislation, Abutments, State governments, Federal government, Political aspects, Administration, Interstate, Regulation, Boundaries (Property), Rivers, Navigation, Construction, Channels, Reinforcement, Interstate rivers, Mississippi River, Ohio River, Structures.
Identifiers: Illinois River, Congress, Pier protection.

The state assents to the construction of bridges across navigable rivers in the state and upon its boundaries whenever the Congress of the United States so authorizes. If any state bordering the Ohio or Mississippi Rivers refuses to grant these privileges for the construction of a bridge over the above mentioned rivers into that state, Illinois will not allow any bridge company from the other state to build a bridge into Illinois. Every person owning or managing a bridge over a navigable portion of the Illinois River shall construct, contiguous to the channel of the river, adequate pier protection for the piers of such bridge. Such construction must be adequate to meet navigation requirements existing at the time and expected during the future life of such piers. (Shevin-Fla)
W69-09830

MISSISSIPPI BRIDGES PURCHASED.

Iowa Code Ann sec 313.66 (Supp 1969).

Descriptors: *Iowa, *Bridges, *Mississippi River, Maintenance, Cities, Highways, Administrative agencies, Local governments, Legislation, Interstate, Interstate rivers.

The Highway Commission may purchase and maintain one half of any bridge over the Mississippi River which is in receivership and which connects a primary road in a city of the state to a corresponding road in an adjoining state. Payment not to exceed $100,000 will be paid from the primary road fund only after the purchase has been approved by the proper board of supervisors, city council and school board or boards and the adjoining state has agreed to purchase the other half of the bridge. (Darragh-Fla)
W69-09834

DRAINAGE.
Ill Ann Stat ch 42, secs 2-1 thru 2-11 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Drains, *Drainage practices, *Surface drainage, Easements, Controlled drainage, Damages, Ditches, Structures, Levees, Construction, Maintenance, Legal aspects, Beneficial use, Legislation, Natural flow, Benefits.
Identifiers: Upland owners, Lowland owners.

Land may be drained in the general course of natural drainage by either open or covered drains. When such a drain is entirely on the land of the owner constructing the drain he is not liable for damages arising from such construction. A covered drain may be extended through the land of others under specified circumstances through the use of specified judicial procedure. The owner of a drain which is extended through the land of others may enter such land to maintain his drain, but is liable for damage he causes. The term 'drains and levees for mutual benefit' is defined and the mutual beneficiaries are given a perpetual easement on all lands concerned. The consent of all existing beneficiaries is required for legal connection to mutually beneficial drains and levees. (Keith-Fla)
W69-09835

WATER NAVIGATION REGULATIONS.

Iowa Code Ann secs 106.12-106.17 (Supp 1969).

Descriptors: *Iowa, *Boating regulations, *Administrative agencies, *Navigation, Legislation, Legal aspects, Boats, Navigable waters, Water skiing, Surf-boarding, Jurisdiction, Federal government, Local governments, State governments, Recreation.
Identifiers: Penalties (Criminal).

No person shall operate any vessel, or manipulate any water skis, surfboard or similar device in a careless, reckless, or negligent manner, nor operate such devices while intoxicated or under the influence of any narcotic, barbituate, or marijuana. Cans, bottles, and other rubbish shall not be discarded in any public waters. No blue or flashing blue light may be used except on authorized emergency vessels. No vessel having over 6 horsepower shall be operated by a person under 12 years of age unless accompanied by a responsible person 18 years of age or over. Fines and imprisonment are established for any person convicted of operating a vessel while intoxicated or under the influence of drugs. Regulations are established for the use of water skis and surfboards. The commission may authorize the holding of regattas, motorboat or other boat races, marine parades, tournaments or exhibitions on any waters of this state under the jurisdiction of the commission. The provisions of this section shall not exempt any person from compliance with applicable federal law or regulation. When any local regulations conflict with any provision of this chapter, the local law will be inoperative. (Heckerling-Fla)
W69-09839

BENEFITED WATER DISTRICTS.

Iowa Code Ann secs 357.1-357.33 (1949), as amended, (Supp 1969), sec 357.34 (Supp 1969).

Descriptors: *Water districts, *Local governments, *Benefits, *Iowa, Legislation, City planning, Assessments, Planning, Contract, Construction, Compensation, Condemnation.

The board of supervisors of any county, upon petition for construction of a water district brought by twenty five percent of the property holders in such proposed water district, may grant a hearing to determine the advisability of such construction. The district may include all or part of any incorporated city with or without surrounding territory. An engineer will be appointed to design the district. After approval of the plan by popular vote, bids will be taken for construction of the district. The project will be paid for by assessments based upon benefits derived. The district trustees are empowered to contract to purchase water for the district if the source of water is without the district. If the source is within the district, they may drill for water and reservoir it. Additional subdistricts or private mains may be constructed. The board of supervisors may condemn needed property. (Darragh-Fla)
W69-09843

VAN DUYSE V FLEMING (NATURAL DRAINAGE OVER ADJACENT LAND).
432 SW 2d 10-11 (Ark 1968).

Descriptors: *Arkansas, *Surface drainage, *Tile drainage, *Drainage effects, Dams, Levees, Ditches, Judicial decisions, Natural flow doctrine, Obstruction to flow, Relative rights, Land tenure, Floods, Silts, Silting, Damages.
Identifiers: *Injunction, Natural drainage.

Appellant and appellee are adjacent landowners. Appellee maintains a dam on his property, water from which drains onto appellant's land. In a prior suit appellant sought damages and an injunction to abate the maintenance of the pond. The trial court found that there was a natural drainageway crossing appellant's land. The court ordered appellant to remove a levee he had constructed to obstruct the natural drainage. The trial court later ordered appellant to construct a drainage ditch and a larger drain tile through the levee. In the present action appellant sought another injunction and damages caused by alleged silting. The chancellor denied appellant's requests and ordered him to comply with the previous court order. The Supreme Court of Arkansas upheld the chancellor's decree on all points. (Harris-Fla)
W69-09851

SOLOMON V CONGLETON (RIGHT TO OBSTRUCT NATURAL WATERCOURSES ANI

SURFACE DRAINAGE).

432 SW 2d 865-868 (Ark 1968).

Descriptors: *Arkansas, *Obstruction to flow, *Natural streams, *Surface drainage, Beds, Banks, Land tenure, Natural flow doctrine, Relative rights, Judicial decisions, Levees, Floods, Surface water, Water discharge, Flow, Swamps, Bogs, Shallow water, Watercourses (Legal).
Identifiers: *Sloughs, Lower landowners, Injunction (Mandatory).

Defendant constructed levees which obstructed the flow of water through a slough emptying into a river. Plaintiff sought a mandatory injunction to require their removal. Since it is unlawful to obstruct a natural watercourse, but lawful for a lower landowner to fend off surface water, the question for the chancellor was whether the slough was a natural watercourse. The chancellor issued the mandatory injunction and the defendant appealed. The Supreme Court of Arkansas in affirming, held that plaintiff had a right to the continued unimpeded flow of any natural watercourse crossing his land. Therefore, defendant must maintain channels sufficient to accommodate such waters in ordinary conditions and reasonably expected flood conditions. The court defined a watercourse to be a stream flowing usually in a particular direction, though not necessarily continually. It must have beds and banks and generally discharge into some other body of water. It is thus something more than mere surface drainage. The chancellor's finding that the slough was a natural watercourse was from disputed facts and the supreme court was unwilling to disturb that finding. (Harris-Fla)
W69-09852

SACHS V CHIAT (DAMAGE FROM SURFACE WATER RUNOFF).

162 NW 2d 243-247 (Minn 1968).

Descriptors: *Minnesota, *Reasonable use, *Alteration of flow, *Surface runoff, Riddance (Legal aspects), Drainage, Water, Repulsion (Legal aspects), Surface waters, Land tenure, Surface drainage, Overland flow, Precipitation excess, Storm runoff, Land use, Legal aspects, Judicial decisions, Natural flow doctrine, Relative rights, Piles (Foundations), Pile driving, Damages, Civil law, Land use.
Identifiers: Injunctions (Prohibitory), Upper landowners, Lower landowners.

Plaintiff and defendant were adjacent land owners in a residential area. The concussion from pile driving during the construction of defendant's residence damaged plaintiff's residence. Surface water draining from defendant's higher land caused injury to plaintiff's land. Plaintiff sought recovery for damages and an injunction to prevent the continuance of drainage. From a verdict for defendant and denial of the injunction, plaintiff appealed. The court reversed on the issue of damages, holding that pile driving was an ultra-hazardous activity and that negligence did not have to be shown for liability to arise. However, a land owner is only liable for damage caused by the flow of surface water from his land if the natural flow is altered by an unreasonable use of the land. A jury could properly find defendant's use of his land reasonable under the circumstances. The injunction was properly denied because defendant had taken measures to avert the harmful flow except under abnormal conditions. (Helwig-Fla)
W69-09857

HAMPTON HARBOR AND BEACH EROSION CONTROL.

NH Rev Stat Ann secs 216-B:1 thru 216-B:6 (1964).

Descriptors: *New Hampshire, *Channel improvement, *Erosion control, *Harbors, Beaches, Erosion, Federal government, Legislation, Costs, Government finance, Shores, State governments, Construction, Construction costs, Contract administration, Administrative agencies, Navigation, Navigable waters, Beach erosion, Projects, United States, Legal aspect, Management.
Identifiers: Army Corps of Engineers, Federal-state cooperation, Federal projects.

The governor, with the advice of the council and upon a finding that federal funds will be available, is empowered to undertake in cooperation with the Army Corps of Engineers a project to improve navigation in Hampton Harbor and a project to restore damaged beach areas resulting from erosion on Hampton Beach. The governor and council are authorized to enter agreements with the federal government to secure federal funds, including an assurance that the state will hold the United States free from all damages arising out of said project. It is anticipated that the Corps of Engineers will supervise the project with such state supervision as necessary resting in the commissioner of public works and highways. Upon completion of the projects, the federal government shall assume maintenance of the harbor entrance channel and facilities. The management of the harbor improvement project shall be supervised by the New Hampshire Port Authority and the supervision of the beach project shall be by the division of parks. Construction contracts shall be administered by the commission of public works and highways. The commission shall cooperate with the Corps of Engineers in studies and construction, and shall provide the governor and council with information to implement this act. (Kahle-Fla)
W69-09864

WATERWAYS, DRAINAGE, FLOOD CONTROL, WATER POLLUTION AND WATER RESOURCES STUDY COMM'N.

Ill Ann Stat ch 19, secs 145.31-145.34 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Drainage programs, *Flood control, *Water pollution control, Water resources, Administrative agencies, Feasibility studies, Legislation, State governments, Local governments, Cost analysis, Inter-agency cooperation, Planning, Administrative costs, Programs, Administration, Financing.

A nine member Waterways, Drainage, Flood Control, Water Pollution and Water Resources Study Commission is created consisting of members from the state Senate, state House of Representatives, and appointees of the governor. The members shall receive no compensation other than actual expenses. The commission shall study: state and municipal problems of waterways, drainage, flood control, water pollution and water resources; the feasibility of plans to promote interagency cooperation in regard to such matters; the costs of administering programs and the sources of revenue for such matters; the feasibility of state programs or grants-in-aid to local governments for such programs; and the need for revision of laws concerning such problems. The commission may request and receive any necessary data and reasonable assistance from state or local officials. The commission may receive gifts or grants from any federal, state, or private agency for the purpose of carrying out its duties. The commission shall report its findings and make recommendations for legislation it deems necessary each odd numbered year. (Kahle-Fla)
W69-09874

4B. Groundwater Management

CLOGGING IN SURFACE SPREADING OPERATIONS FOR ARTIFICIAL GROUNDWATER RECHARGE,
Agricultural Research Service, Fresno, Calif. Groundwater Recharge Field Station.
Jerold J. Behnke.
Water Resources Res, Vol 5, No 4, p 870-876, Aug 1969. 7 p, 5 fig, 2 tab, 11 ref.

Descriptors: *Water spreading, *Filtration, *Artificial recharge, *Permeability, Turbidity, Porous media, Particle size, Porosity, Suspended load.
Identifiers: Filter clogging.

Clogging is a complex phenomenon dependent upon many variables. For the conditions studied it is essentially a surface-sealing process. When turbid water contains a range of grain sizes, clogging is initiated by the deposition of a surface layer that is graded because of the gravitational segregation of heavier particles. Most of the clogging results from the straining of finer particles from the flowing water by the graded depositional layer. An equation was developed which predicts accumulated water quantity versus time relationships for several concentrations of a specific turbidity. Even coarse-grained porous media clogged at turbid water concentrations as low as 50 ppm. (Knapp-USGS)
W69-09468

TRANSIENT PRESSURE TESTING OF FRACTURED WATER INJECTION WELLS,
Pan American Petroleum Corp., Tulsa, Okla.
For primary bibliographic entry see Field 02F.
W69-09499

STEADY-STATE FLOW CAPACITY OF WELLS WITH LIMITED ENTRY TO FLOW,
Mobil Research and Development Corp., Dallas, Tex.
For primary bibliographic entry see Field 02F.
W69-09501

KOCIAN V DEVITO (IMPLIED WARRANTY IN DIGGING WELL).
For primary bibliographic entry see Field 06E.
W69-09613

AQUIFER BEHAVIOR WITH INJECTION,
Petrobras Co., and Texas A and M Univ., College Station.
E. J. Bonet, and Paul B. Crawford.
J Petrol Technol, p 1210-1216, Sept 1969. 7 p, 6 fig, 13 ref, append.

Descriptors: *Injection wells, *Mathematical studies, Groundwater movement, Flow, Flow rates, Aquifers, Oil reservoirs, Recharge, Secondary recovery (Oil).
Identifiers: Linear closed aquifer analysis.

Water injection flow was analyzed mathematically and the results are presented in terms of dimensionless variables. In injection into linear closed aquifers the total flow across a section depends only on proximity to the injection well and has no relation to the well's distance from aquifer boundaries. (Knapp-USGS)
W69-09650

HUMBOLDT RIVER STUDIES,
Nevada Univ., Reno. Desert Research Inst.
W. R. Larson, R. D. Winnergren, E. P. Zeizel, P. A. Domenico, and C. Case.
Nevada Center for Water Resources Research Project Report No 10, Jul 1968. 104 p, 13 fig, 9 tab, 38 ref, 7 append. OWRR Project A-010-NEV.

Descriptors: *River Basin development, *Surficial geology, Irrigation, Sediments, Wells (High yield), Recharge (Artificial), *Statistical technique, High flow.
Identifiers: *Humboldt River Basin.

The maximum beneficial use of the total water supply for irrigation in Humboldt River Basin requires that both surface water and groundwater be used. Successful integration of these supplies entails hydrogeologic, legal and economic considerations. In that the Humboldt River Basin sediments

are highly transmissive and, therefore, capable of producing high yield wells, the hydrogeologic problem was reduced to ascertaining the potential for recharge. This problem is analyzed by applying statistical techniques to high flows and to the relationship between recharge and surficial geology, and by field mapping. The legal problem centers around acquisition of rights to pump, anticipated interference with surface water rights, priorities, possibility of artificial recharge, and forfeiture due to nonuse during periods of sufficient water. The economic problem is complicated in that groundwater is to be used to supplement a stochastic surface water supply with a deterministic demand. Further, the nonconcurrence of the areas of major water use and the most productive aquifers involves costs that may preclude use of groundwater altogether. The economic problem is analyzed in terms of current net benefits of surface water and influence of supplemental pumping on these benefits. (Johnson-Univ of Nev)
W69-09724

4C. Effects on Water of Man's Non-Water Activities

FOLEY V STATE (DAMAGES FOR ELIMINATION OF WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W69-09610

MOREY V STATE (LIABILITY FOR HIGHWAY CHANGE OF GRADE).
For primary bibliographic entry see Field 06E.
W69-09611

FEDERAL WATER RESOURCES PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09640

HYDROGEOLOGICAL EQUATIONS FOR DETERMINING GROUNDWATER YIELDS IN THE DRAINAGE OF OPENCAST MINES AND LARGE BUILDING PITS (GERMAN),
For primary bibliographic entry see Field 02F.
W69-09648

SEDIMENT MOVEMENT IN AN AREA OF SUBURBAN HIGHWAY CONSTRUCTION, SCOTT RUN BASIN, FAIRFAX COUNTY, VIRGINIA, 1961-64,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W69-09683

BALTIMORE'S WATERSHEDS: AN EXAMPLE OF INTEGRATED LAND USE,
Forest Service (USDA), Washington, D.C. Div. of Watershed, Recreation, and Range Research; and Bureau of Water Supply, Baltimore, Md.
Irvin C. Reigner, and Louis G. Ningard.
Journal American Water Works Association, Vol 59, No 11, p 1469-1477, illus, 1967.

Descriptors: *Watershed management, *Water supply, *Forest management, *Recreation, Aesthetics, Fishing, Land use, Public health, Recreation demand, Recreation wastes, Reservoirs, Sediment control, Water yield improvement, Multiple-purpose projects, Maryland.
Identifiers: *Logging (Forest), *Experimental watersheds.

Municipal watersheds are being subjected to increasing pressure for other uses. This paper presents a brief description and history of forest management on the 17,300-acre watershed owned by the city of Baltimore, Maryland. Water quality protection, timber production, and recreation are the three principal functions of the area. A knowledge of how these uses are successfully accommodated on one watershed should help managers in other areas.
W69-09761

PLAN AND PROGRAM FOR THE BRANDYWINE,
Pennsylvania Univ., Philadelphia. Inst. for Environmental Studies.
For primary bibliographic entry see Field 06B.
W69-09768

CHANGES IN ROADS, STREAMS, OR DRY RUNS.

Iowa Code Ann sec 306.21 (Supp 1969).

Descriptors: *Iowa, *Highway relocation, *Bodies of water, *Diversion, Alteration of flow, Road construction, Legislation, Administrative agencies, Bridge construction, Streams, Dry beds, Safety, Erosion control.

Boards of supervisors on their own motion may change the course of any secondary road, stream, or dry run in any county to avoid the construction and maintenance of bridges, grades, or railroad crossings, or to cut off dangerous turns and prevent encroachment of streams on the highways. (Harris-Fla)
W69-09837

4D. Watershed Protection

RESTORATION OF GULLIED VALLEY FLOORS IN ARID AND SEMIARID REGIONS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W69-09506

RELATION OF SOIL PROPERTIES TO ITS ERODIBILITY,
Agricultural Research Service, Lafayette, Ind.; and Purdue Univ., Lafayette, nd.
W. H. Wischmeier, and J. V. Mannering.
Soil Sci Soc Amer Proc, Vol 33, No 1, pp 131-137, Jan-Feb 1969. 7 p, 1 fig, 4 tab, 17 ref.

Descriptors: *Soil properties, *Erosion, Erosion control, Slopes, Soil density, Infiltration, Rainfall-runoff relationships, Rainfall, pH, Soil chemical properties, Runoff, Soils, Soil science, Soil tests, Land use, Subsoil, Soil texture, Organic matter, *Agriculture, Bibliographies.
Identifiers: *Erosion index, Infiltration capacity.

The inherent erodibility of soil, a major factor in erosion prediction and land-use planning, is a complex property dependent on infiltration capacity and capacity to resist detachment and transport by rainfall and runoff. The relations of these capacities to soil physical and chemical properties were investigated in a 5-yr field, laboratory, and statistical study including 55 selected Corn Belt soils. Properties that contributed significantly to soil-loss variance included percentages of sand, silt, clay, and organic matter; pH, structure, and bulk density of plow layer and subsoil; steepness and concavity or convexity of slope; pore space filled by air; residual effects of sod crops; aggregation; parent material; and various interactions of these variables. An empirical equation was derived for calculating the erodibility factor K of the universal soil-loss equation for specific soils. Tests of the equation against soils of the older erosion-research stations, for which the erodibility factor is known, substantiated general applicability over a broad range of medium-textured soils. (USBR)
W69-09534

A NEW EXAMINATION OF SEDIMENT SUSPENSION IN OPEN CHANNELS,
Agricult ural Research Service, Oxford, Miss.
Neil L. Coleman.
J HYDRAUL Res, Vol 7, No 1, p 67-82, 1969. 16 p, 8 fig, 1 tab, 10 ref, append.

Descriptors: Open channel flow, *Sediment concentration, *Sediment distribution, Sediment load, *Suspended sediments, Turbulence, Rivers, Channels, Flumes, Hydraulic models, Boundary layers, Channel flow, Fluid flow, River flow, Streamflow, Reynolds number, *Sediment transport, Hydraulics, Hydrology.
Identifiers: Channel beds.

The concentration of suspended sediment near the bed of a channel is inversely proportional to the distance from the channel boundary. Further from the boundary in the open stream, the concentration varies exponentially. This effect suggests that open-channel flows with suspended sediment can be divided into an inner suspension region near the bed and an outer suspension region in the free stream, with different sediment transfer processes in the 2 zones. Analyses were made of sediment concentration profiles from river measurements and laboratory flume experiments. Equations were derived for relative sediment concentration in both zones. The thickness of the inner suspension zone correlates with the displacement boundary thickness; the ratio of sediment boundary layer thickness to total flow depth correlates with Reynolds number but not with the ratio of shear velocity to mean velocity. The sediment transfer ratio varies linearly with elevation above channel bottom in the inner suspension zone and is constant in the outer zone. (USBR)
W69-09535

SUCCESSFUL SAND CONTROL DESIGN FOR HIGH RATE OIL AND WATER WELLS,
Signal Oil and Gas Co., Los Angeles, Calif.
For primary bibliographic entry see Field 02J.
W69-09649

SOIL EROSION CONTROL PRACTICES IN PERSPECTIVE,
Harza Engineering Co., Chicago, Ill.
For primary bibliographic entry see Field 02J.
W69-09660

SOIL EROSION AND CONSERVATION IN NORTHERN JORDAN,
Durham Univ. (England). Dept. of Geography.
P. Beaumont, and K. Atkinson.
J Soil and Water Conserv, Vol 24, No 4, p 144-147, Aug 1969. 4 p, 4 fig.

Descriptors: *Soil erosion, *Erosion control, *Social aspects, Farm management, Land management, Soil conservation, Governments, Vegetation establishment, Water control, Cover crops.
Identifiers: *Jordan.

The way of life of the people in northern Jordan promotes continued misuse of the land and hinders the adoption of erosion control programs. In work completed thus far, attention has been almost exclusively concentrated on improving areas of land owned by the government. Relatively little consideration has been given to the improvement of agricultural practices which are, in the final analysis, the root cause of the erosion problem. The government's role in new programs should be confined to financing large capital projects, for example, dam construction, and intensifying research concerning the relative productivity of different agricultural patterns and crops. Villages should implement conservation at the local level under their own initiative. This will be difficult to instigate in a traditionally rural society. (Knapp-USGS)
W69-09663

HYDROLOGIC RESEARCH FOR WATERSHED ENGINEERING,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
H. N. Holtan.
J Hydrol, Vol 8, No 2, p 207-216, June 1969. 10 p, 4 ref.

Descriptors: *Water resources development, *Water management (Applied), Planning, Rainfall-runoff relationships, Stochastic processes, Markov processes, Probability, Systems analysis, Meteorology, Hydrogeology, Hydraulics, Reviews, International hydrological decade.
Identifiers: Watershed engineering.

Watershed engineering is dynamically increasing its scope and vitality in order to integrate a complexity of interests in land and water resources. Agriculture, industry and urban interests vie for the choicest land areas, often with contrasting objectives that can be made compatible only through basin planning. Hopefully, the current effort of the International Hydrologic Decade will supply concepts and information helpful to the hydrologic phases of watershed engineering. This article is written to inspire objective thinking in the selection of watersheds for research and in the design of the research model. Both stochastic and deterministic approaches are needed but they require different types of research watersheds, and, most definitely, they require different research models. (Knapp-USGS)
W69-09669

GROUNDWATER RESOURCES OF THE BURIED MAHOMET BEDROCK VALLEY,
Illinois State Water Survey, Urbana. Water Supply Div.
For primary bibliographic entry see Field 02F.
W69-09738

IMPORTANCE OF THE BOIS BRULE RIVER TO RECENT SEDIMENTATION HISTORY OF WESTERN LAKE SUPERIOR,
Wisconsin State Univ., Superior.
For primary bibliographic entry see Field 02J.
W69-09773

SOIL CONSERVATION.

Iowa Code Ann secs 467A.1 to 467A.41 (Supp 1969).

Descriptors: *Iowa, *Soil conservation, *Erosion control, *Administrative agencies, Soil erosion, Legislation, Watershed management, Flood control, Soil management, Sediment control, Conservation, Preservation, State governments, Adjudication procedure, Legal aspects, Assessments, Taxes, Operating costs.

It is declared to be the policy of the Iowa legislature to provide: (1) for the restoration and conservation of the soil and soil resources of the state; (2) for the control and prevention of soil erosion; and (3) for the prevention of erosion, floodwater, and sediment damages. Such provisions shall serve to preserve natural resources, control floods, prevent impairment of dams and reservoirs, assist and maintain the navigability of rivers and harbors, preserve wildlife, protect the tax base, protect public lands, and promote the health, safety and public welfare. The state soil conservation committee is established, and its powers and duties are enumerated. Provisions for the creation of soil conservation districts and district commissioner offices are set forth as are the powers of the districts and commissioners. Subdistricts for the purpose of carrying out watershed protection and flood control programs are authorized and procedure for their formation outlined. Powers of the subdistricts include the power to levy a special annual tax and to tax for watershed protection and flood prevention, to condemn land and interests, and to make assessments for improvements. (Marsee-Fla)
W69-09838

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

PESTICIDES IN SELECTED WESTERN STREAMS-A PROGRESS REPORT,
Geological Survey, Austin, Tex.
Douglas B. Manigold, and Jean A. Schulze.
Pesticides Monit J, Vol 3, No 2, p 124-135, Sept 1969. 12 p, 1 fig, 3 tab, 8 ref.

Descriptors: *Pesticide residues, *Surface waters, *Sampling, *Surveys, *Data collections, Monitoring, Chemical analysis, Gas chromatography.
Identifiers: Pesticide monitoring.

Data are presented from the U.S. Geological Survey program for monitoring pesticides in the streams of the Western United States in the period October 1966-September 1968. The original network of 11 monthly sampling stations, established in October 1965, was increased to 20 in October 1967. Compounds determined include the common chlorinated insecticides and herbicides. All of these pesticides were detected at one time or another; DDT was the most frequently occurring insecticide, and 2,4-D the most common herbicide. The amounts observed were small; the maximum concentrations of DDT and 2,4-D were 0.12 and 0.35 microgram/liter, respectively. Concentrations were highest in the water samples that contained appreciable amounts of suspended sediment. Data obtained thus far in the operation of the network have been insufficient to show real correlation with discharge or season of the year. (Knapp-USGS)
W69-09447

EFFECT OF LIGHT INTENSITY ON PHOTOSYNTHESIS BY THERMAL ALGAE ADAPTED TO NATURAL AND REDUCED SUNLIGHT,
Indiana Univ., Indianapolis. Dept. of Microbiology.
For primary bibliographic entry see Field 02K.
W69-09676

THE ANNUAL AND DIURNAL VARIATION IN THE VERTICAL DISTRIBUTION OF ACID-SOLUBLE FERROUS AND TOTAL IRON IN A SMALL DIMICTIC LAKE,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Biology and Health Physics Div.
J. W. McMahon.
Limnol and Oceanogr, Vol 14, No 3, p 357-367, May 1969. 11 p, 8 fig, 24 ref.

Descriptors: *Lakes, *Stratification, *Iron, *Iron compounds, *Diurnal distribution, Acidic water, Photoactivation, Metabolism, Microorganisms, Analytical techniques, Seasonal, Dissolved oxygen, Spectrophotometry, Sampling, Biological properties, Water temperature, Water circulation, Iced lakes.
Identifiers: Dimictic Lakes, Ferrous ion concentrations.

Variation in the vertical distribution of dissolved iron in Upper Bass Lake, Ontario from March 1966 to February 1967 was measured photometrically using the ferrous specific reagent bathophenanthroline. Acid-soluble ferrous iron was presented throughout all strata with the concentration flucuating in a definite annual pattern. Values of ferrous ion change hourly and follow a diurnal pattern. The concentration of ferrous ion in lake water may be controlled by photochemical reactions and, perhaps, also by metabolic activity of microorganisms. (Gabriel-USGS)
W69-09677

USE OF ENDOCOMMENSAL MOLLUSCAN CILIATED PROTOZOA AS INDICATORS OF WATER QUALITY AND POLLUTION IN ILLINOIS WATERS,
Illinois Univ., Urbana. Water Resources Center.
Eugene B. Small, and Gregory A. Antipa.
Research Report No 24, Water Resources Center, University of Illinois, July 1969. 27 p, 9 fig, 1 table, 31 ref. OWRR Project A-015-Ill.

Descriptors: *Indicators, *Protozoa, Infection, *Mollusks, Water pollution effects, Water quality.
Identifiers: Endocommensal molluscan ciliated protozoa.

Fifteen species of unionid bivalves from seventeen localities in Central Illinois were carefully examined for ciliate protozoan infections. Many ciliates appeared occasionally, but the thigmotrich ciliates Conchophthirus and Heterocinetopsis unionidarum appeared abundantly and consistently. Although Conchophthirus and Heterocinetopsis were the only thigmotrichs uncovered in this study, the isolation of Heterocinetopsis suggests that other thigotrich ciliates may also be found in Illinois. The ciliates Conchophthirus and Heterocinetopsis were tested for their ability to react as very delicate indicators of water quality by planting infected bivalves in areas of known pollution. At intervals after planting, individuals were recovered and carefully examined for the relative abundance of Conchophthirus and Heterocinetopsis. The preliminary results suggest that Heterocinetopsis may be the most critical indicator of biological pollution currently available for Illinois waters. (Betchart-Univ of Ill.)
W69-09718

BIOASSAYS FOR MICROCHEMICAL ENVIRONMENTAL CONTAMINANTS,
Foundation of Environmental Biology, Berkeley, Calif.
Richard E. Warner.
Bulletin World Health Organization, Vol 36, p 181-207, 1967. 6 fig, 221 ref.

Descriptors: *Bioassay, *Water pollution sources, Water quality, Water pollution effects, Bibliographies, Bioindicators, Lethal limits, Toxicity, Behavior, Physiological ecology, Environmental effects, Biochemistry, Growth rates.
Identifiers: *Microchemical contaminants, *Environmental contaminants, Histochemical effects, Embryological effects, Regeneration effects, Sensory physiology.

Bioassay procedures, as adapted to the study of actual and potential contaminants of the environment, are reviewed in considerable detail. The methods are grouped according to the nature of the response of the indicator organisms. The following groupings are used: (1) acute response (usually death), (2) behavioural change, (3) physiological change, (4) biochemical and histochemical change, (5) ecological change, (6) embryological and regenerational change, (7) growth change, (8) histological change, and (9) changes perceived by humans or aquatic organisms. Consideration is given to the selection of appropriate tests, the problem of sequential concentration, and the establishment of response syndromes. It is concluded that the essential step of standardizing bioassay techniques must be taken if significant progress is to be made. (Uttormark-Wis)
W69-09749

CHEMICAL WATER QUALITY SURVEY OF THE SURFACE WATERS OF THE BOIS BRULE RIVER AND ITS WATERSHED, WISCONSIN, TRIBUTARY TO LAKE SUPERIOR,
Wisconsin State Univ., Superior.
Donald A. Bahnick, Joseph W. Horton, and R. K. Roubal.
Univ of Wisconsin, Water Resources Center, Report, 1969. 20 p. OWRR Proj A-023-Wis.

Descriptors: *Water quality, *Surface waters, *Wisconsin, Chemical oxygen demand, Dissolved oxygen, River basins, Hydrogen ion concentration, Suspended load, Color, Electrical conductance.
Identifiers: *Bois Brule River (Wis), Northwestern Wisconsin.

A study of certain chemical parameters for the Bois Brule River, Wisconsin Watershed is presented. This study was undertaken in order to establish 'wild river' conditions for streams in the northwestern Wisconsin area. Measurements of nitrogen, phosphorus, copper, dissolved oxygen, chemical oxygen demand, electrical conductivity, pH, total solids, and water color were made during a two month period (1968) at 52 stations along the river and its tributaries. The results of this study are correlated with station locations and rainfall whenever possible. (Bahnick-Wis State Univ)
W69-09770

5B. Sources of Pollution

PESTICIDES IN SELECTED WESTERN STREAMS-A PROGRESS REPORT,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 05A.
W69-09447

POLLUTION AND EUTROPHICATION PROBLEMS OF GREAT SOUTH BAY, LONG ISLAND, NEW YORK,
New York State Dept. of Conservation, Ronkonkoma.
For primary bibliographic entry see Field 05C.
W69-09453

PHOTOSYNTHETIC OXYGEN PRODUCTION IN A POLLUTED TROPICAL ESTUARY,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05C.
W69-09455

CONCEPTS OF FECAL STREPTOCOCCI IN STREAM POLLUTION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
Edwin E. Geldreich, and Bernard A. Kenner.
J Water Pollut Contr Federation, Vol 41, No 8, Part 2, p R336-R352, Aug 1969. 17 p, 3 fig, 6 tab, 37 ref, 1 append.

Descriptors: *Streptococcus, *Coliforms, *Bioindicators, *Water pollution sources, Aquatic bacteria, Runoff, Storm runoff, Water pollution, Surveys, Sampling, Water pollution effects.
Identifiers: *Fecal streptococci, Bacterial survival times.

Results of an intensive study on the occurrence and strain distribution for 12,536 fecal streptococcus strains found in warm-blooded animal feces and numerous water sources from a wide geographical area reveal several new factors that must be understood for a proper interpretation of the sanitary significance of this bacterial group in water pollution studies. The ubiquity of Streptococcus faecalis var. liquifaciens in the water environment and the occasional occurrence of an atypical S. faecalis associated with vegetation shows the need for including the fecal-coliform examination in recreational water quality measurements. Applications of the fecal streptococcus indicator system in stream pollution are the development of fecal coliform to fecal streptoccus ratios that will further define possible sources of the fecal discharge into the stream; and the detection of the S. bovis and S. equinus subgroup which was not found in human feces and may be considered a specific indicator of non-human animal pollution. (Knapp-USGS)
W69-09456

EFFECT OF ENVIRONMENTAL FACTORS ON BENTHAL OXYGEN UPTAKE,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering and Dow Chemical Co., Midland, Mich. Waste Treatment Div.
For primary bibliographic entry see Field 05C.
W69-09457

EFFECT OF SLUDGE DEPTH ON OXYGEN UPTAKE OF A BENTHAL SYSTEM,
Perkins (Dana F.) and Sons, Inc., Reading, Mass.; and Tufts Univ., Medford, Mass.
For primary bibliographic entry see Field 05C.
W69-09474

LINDANE DIFFUSION IN SOILS:[1]. THEORETICAL CONSIDERATIONS AND MECHANISM OF MOVEMENT,
California Univ., Riverside. Dept. of Soils and Plant Nutrition; and Agricultural Research Service, Riverside, Calif.
Wilfried Ehlers, J. Letey, W. F. Spencer, and W. J. Farmer.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 501-504, July-Aug 1969. 4 p, 4 fig, 10 ref.

Descriptors: *Diffusion, *Insecticides, *Soils, *Pesticide kinetics, Soil water movement, Path of pollutants, Mass transfer, Thermodynamic behavior, Chlorinated hydrocarbon pesticides, Saturated flow, Unsaturated flow.
Identifiers: *Lindane.

Equations are developed to describe the combined vapor and 'nonvapor' phase diffusion of a volatile insecticide in soils and compared with the diffusion of lindane in a Gila silt loam in a transient state system. The quantity of diffused lindane appears to increase linearly with increased lindane concentration in the treated soil up to about 20 ppm but deviates from linearity at higher concentrations. The diffusion coefficient of lindane is independent of time until 22 ppm of the initial 80 ppm lindane concentration in the treated soil have diffused into the formerly untreated soil. The diffusion rate then decreases rapidly. The dependency of the diffusion coefficient on concentration and time may be explained by the fact that lindane will reach maximal vapor density in the range of 20 to 30 ppm. After these concentrations are built up in the initially untreated half-cells by diffusion, vapor diffusion approaches zero and all the diffusion is in the 'nonvapor' phase. At a 10% soil water content, 50% of the lindane diffuses in the vapor phase and 50% in the 'nonvapor' phase. At near saturation, total diffusion is in the 'nonvapor' phase. Lindane diffusion in soils can easily change from 'nonvapor' to vapor phase and back to 'nonvapor' phase. (Knapp-USGS)
W69-09477

LINDANE DIFFUSION IN SOILS:[2]. WATER CONTENT, BULK DENSITY, AND TEMPERATURE EFFECTS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition; and Agricultural Research Service, Riverside, Calif.
Wilfried Ehlers, W. J. Farmer, W. F. Spencer, and J. Letey.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 505-508, July-Aug 1969. 4 p, 3 fig, 4 tab, 9 ref. USDA Contract 12-14-100-9016 (41).

Descriptors: *Diffusion, *Adsorption, *Insecticides, *Soils, *Pesticide kinetics, Soil water movement, Path of pollutants, Mass transfer, Thermodynamic behavior, Chlorinated hydrocarbon pesticides, Saturated flow, Unsaturated flow.
Identifiers: *Lindane.

The diffusion of lindane in Gila silt loam is strongly influenced by soil water content, bulk density, and temperature. The diffusion coefficient is nearly zero in soil of 1% water content. With an increase in .3% water content, which is equivalent to 2 layers of water between the montmorillonite clay plates, water is able to displace the lindane from the adsorbing surface so that the diffusion coefficient becomes maximal. A small additional increase in water content reduces the diffusion coefficient to about one-half of the maximal value. This value then remains constant with increasing water content up to saturation. Decreasing bulk density or increasing temperature raises the diffusion coefficient. The influence of bulk density and temperature on diffusion is in good agreement with theoretical calculations. (Knapp-USGS)
W69-09478

VAPOR DENSITY OF SOIL-APPLIED DIELDRIN AS RELATED TO SOIL-WATER CONTENT, TEMPERATURE, AND DIELDRIN CONCENTRATION,
California Univ., Riverside. Dept. of Soils and Plant Nutrition; and Agricultural Research Service, Riverside, Calif.
W. F. Spencer, M. M. Cliath, and W. J. Farmer.
Soil Sci Soc Amer Proc, Vol 33, No 4, p 509-511, July-Aug 1969. 3 p, 4 fig, 9 ref.

Descriptors: *Dieldrin, *Vapor pressure, *Soil moisture, *Pesticide kinetics, Drying, Evaporation, Water loss, Volatility, Pesticide residues, Soil physics, Soil chemistry.
Identifiers: Vapor density (Pesticides), HEOD.

Vapor densities of dieldrin, which consists principally of HEOD or hexachloroepoxyoctahydroendo, exo-dimethanonaphthalene in dieldrin-soil mixtures increased with temperature and dieldrin concentration but were not affected by soil-water content until the water content decreased below that equivalent of one molecular layer of water. Vapor densities dropped to very low values when the water content fell below this level, but increased again as water was added to the dry soil, indicating that the drying effect is reversible. When more than a monomolecular layer of water was present in the soil, vapor density increased, with increasing soil concentration until a saturation vapor density equal to that of HEOD without soil was reached at approximately 25 ppm HEOD. This implies that surface applications of dieldrin and probably other similar chlorinated hydrocarbon insecticides will volatilize as rapidly from mineral soils as from the pure materials until the concentration at the surface fails to relatively low levels. Loss of water is not required for significant rates of volatilization to occur from soils or other surfaces on which water can successfully compete for adsorption sites. (Knapp-USGS)
W69-09479

OXYGEN UPTAKE RATES OF BENTHAL DEPOSITS ON THE UPPER PASSAIC RIVER,
Rutgers - The State Univ., New Brunswick, N.J.
O. M. Donovan, and J. V. Hunter.
Paper presented at ASME/AIChE Water Pollution Conference, June 1969. Publ by Water Resources Research Institution, Rutgers University, 1969. 27 p, 5 tab, 4 fig, 17 ref. FWPCA Contract 16080 DUP.

Descriptors: *Benthos, *Water pollution, *Biochemical oxygen demand, Oxygen demand.
Identifiers: *Oxygen demand, Benthal, Benthal respirometer, Stream bottom, Oxygen balance, Oxygen sink.

An in situ benthal respirometer was utilized to determine benthal oxygen demands on the Passaic River near Little Falls, New Jersey. Different deposits on the stream were examined. These exhibited demands ranging from 1.13 g/m2-day to 3.79 (2)-day, with an average demand of 2.22 g/m2-day. These demands were then examined from the viewpoint of their effects upon the overall stream oxygen balance. It was found that the benthic demand upon the supernatant water ranged from 0.261 mg/1-day at a flow rate of 200 cfs to 0.120 mf/1-day at flow rate of 1400 cfs. These data are presented in tabular and graphic forms in subsequent sections of this paper. (Whipple-Rutgers)

W69-09557

AQUIFER BEHAVIOR WITH INJECTION,
Petrobras Co., and Texas A and M Univ., College Station.
For primary bibliographic entry see Field 04B.
W69-09650

AGRICULTURE'S CONTRIBUTION TO THE FERTILIZATION OF CANAL LAKE,
Guelph Univ. (Ontario). Dept. of Soil Science.
For primary bibliographic entry see Field 05C.
W69-09662

EFFECT OF VARIOUS FACTORS ON MOVEMENT OF NITRATE NITROGEN IN SOIL PROFILES AND ON TRANSFORMATIONS OF SOIL NITROGEN,
Wisconsin Univ., Madison.
R. J. Olsen.
Univ of Wisconsin, Water Resources Center, Report 1969. 79 p. OWRR B-004-Wis.

Descriptors: *Nitrification, *Soil nitrogen, *Public health, *Soil leaching, Groundwater, Soil profiles, Water table, Surface runoff, Farm wastes, Aerobic conditions, Incubation.
Identifiers: *Lake eutrophication, *Soil phosphorus, Alfalfa-bromegrass, Spring thaws, Fertilizer-nitrogen.

There is increasing evidence that agriculture is contributing to the increase in nitrate-nitrogen in streams, lakes, and domestic water supplies. High amounts of nitrate-nitrogen in water are a health hazard and contribute to lake eutrophication. Methods by which nitrogen may enter the water from agricultural sources include the leaching of nitrate-nitrogen through the soil profile to the water table and surface runoff, especially during spring thaws from manure applied to frozen soil during the winter. The data obtained from field experiments indicate that pollution of groundwater with nitrate-nitrogen can be limited by avoiding excessive rates of fertilizer nitrogen; providing a crop cover on the soil during the growing season; use of hay crops, such as alfalfa-bromegrass, in rotation with corn or other crops receiving fertilizer nitrogen; and not permitting unprotected manure to accumulate during the time of year when leaching can occur. Recovery of fertilizer nitrogen by three successive corn crops and as soil inorganic nitrogen following the last crop ranged from 72 to 88 percent. The average concentration of nitrate-nitrogen in the soil solution at the lowest profile depth sampled ranged from 14 ppm for virgin soils to 21 ppm for manure contaminated soils and to 33 ppm for cultivated soils. Rate of nitrification was directly related to the rate of manure application, presence of aerobic conditions, period of incubation, and soil phosphorus. The average recovery of nitrogen by chemical analysis of the soil receiving the higher manure rates after 37 weeks of incubation ranged from 24% for anaerobic conditions to 73 to 80 percent for the aerobic conditions. These data suggest that where animal manure is not to be used as a fertilizer, lagooning of the manure under anaerobic conditions may be an effective method of disposal with a minimum risk of water pollution. (Olsen-Univ of Wis)
W69-09721

CHEMICAL REACTOR THEORY APPLIED TO MODELING THE DYNAMICS OF A CONTROL SYSTEM FOR WATER QUALITY OF A RIVER; PHASE I--A FEASIBILITY STUDY,
Maine Univ., Orono.
Edward G. Bobalek, Kenneth I. Mumme, and Ronald A. Lewis.
Proj Completion Rept, Maine Water Resources Center, Jul 1967. 39 p, Stab, 8 fig, 39 ref, 2 append. OWRR Proj B-001-ME.

Descriptors: *Computer models, Mixing, Waste dilution, *Control systems.
Identifiers: *Penobscot River Estuary, Dynamic system, Residence times.

This study was aimed to provide an exploratory appraisal of the feasibility of conducting an extensive experimental probing of a selected river system. Such experiments would have the ultimate goal of providing an accurate and workable model of one typical system in the State of Maine. Such a model would be used to implement an overall control scheme which can provide a basis for engineering decisions on regulating waste discharges into the river under conditions which do not overload the capability of the river to purge itself so as to restore water qualities affected by pollution loading. The Penobscot River estuary was selected as representative of conditions existing in the state with respect to water pollution. Existing models are inadequate for several reasons in analysing this type of dynamic estuary system. Feasibility of alternative approaches was explored by using computer simulations which attempted to predict the chemical reactor performance of the river assuming reasonable values of input variables.
W69-09731

CHEMICAL REACTOR THEORY APPLIED TO MODELING THE DYNAMICS OF A CONTROL SYSTEM FOR WATER QUALITY OF A RIVER; PHASE II--STUDY OF A RIVER SYSTEM AS A CHEMICAL REACTOR,
Maine Univ., Orono.
Edward G. Bobalek.
Proj Completion Rept, Me Water Resour Center, Aug 1969. 21 p, 5 fig. OWRR Proj B-003-ME.

Descriptors: *Computer models, Mixing, Waste dilution, *Control systems.
Identifiers: *Penobscot River Estuary, Dynamic system, Residence times.

Phase II (OWRR: B-003-ME), which extends the study of Phase I (OWRR: B-001-ME), projects the modelling of a river system as a tubular chemical reactor which can purge itself of oxidizable organics if scheduling of pollution inputs from known sources is guided by a feed-forward control scheme which responds to continuous monitoring of the chemical kinetics profile of the river system. The data requirements of the tentative river model proposed in Phase I has served its primary objective in guiding design, construction and performance testing under real and simulated service conditions of an instrumental, hardware system for continuous acquisition of data on salinity, temperature and oxygen content with depths at variable sampling sites. Although this first model was the basis for establishing requirements for river analysis, further developments of the pollution abatement goals are no longer dependent on adequacy of this first approximation to modelling. Comprehensive control schemes have been developed which are applicable to any adequate river model which can evolve from a history of data acquisition. At the conclusion of Phase II, the progress achieved is (1) Application of control theory, supported by software development, to make possible testing and validation of any tentative river model as a basis for a feed-forward control scheme. (2) Placement of four variants of pilot models of hardware systems into service for long-term performance evaluation in continuous acquisition, transmission, storage and processing of data which define the down-stream reaction potential of the river. Phase III (OWRR: B-005-ME), to validate the technical feasibility of the control schemes and to generate and appraise adequacy of improved river models is now continuing in the 25-mile tidal reach of the Penobscot River between the Bangor dam and the throat of Penobscot Bay at Bucksport, Maine.
W69-09732

RADIUM IN NATURAL WATERS IN THE UNITED STATES,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 05C.
W69-09744

WILL THE USE OF 2,4,5-T TO CONTROL STREAMSIDE VEGETATION CONTAMINATE PUBLIC WATER SUPPLIES,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station; Pennsylvania State Univ., University Park, Pa.; and Amchem Products, Inc., Ambler, Pa.
Irvin C. Reigner, William E. Sopper, and Roy R. Johnson.
Journal of Forestry, Vol 66, No 12, p 914-918, December 1968.

Descriptors: *Watershed management, *2-4-5-T, *Herbicides, *Riparian plants, Water yield improvement, Water supply, Organoleptic properties, Odor, Taste, Domestic water, Water quality, Brush control, Phenolic pesticides, New Jersey, Pennsylvania.

Riparian vegetation along two small headwater streams in Pennsylvania and New Jersey was treated with 2,4,5-T. Water samples were collected immediately after treatment and periodically thereafter for three weeks. Odor tests were used to determine the degree of contamination. Results indicated that only slight contamination occurred within the treated sections of streams immediately after treatment and in two instances after the first large storm. No contamination was detected downstream. Vegetation analysis one year after treatment indicated that the ester formulation had completely killed 70 to 81 percent of the stems and that the emulsifiable acid had killed 58 to 78 percent. Results of this study provide additional evidence that phenoxy herbicide, if applied with normal precautions, can be used on municipal watersheds without creating any water contamination.
W69-09763

POLLUTION OF WATER FROM AGRICULTURAL SOURCES,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
Lloyd L. Harrold.
The Ohio Engineer, Vol 29, No 4, p 10, Apr 1969. 16 p, 3 ref.

Descriptors: *Water pollution, *Agricultural chemicals, *Fertilizer, *Animal waste, *Water pollution sources, Leaching, Streamflow, Erosion.
Identifiers: *Farm chemicals, *Food production, Automatic sampler.

USA became the world's foremost food quality and quantity producer by use of farm fertilizer and other chemicals. Phosphate fertilizer and dieldrin pesticide attach to soil and do not dissolve readily in runoff water. They become a significant part of the pollution of water bodies only as soil is eroded by runoff water. Nitrate fertilizer polluts surface and subsurface water bodies where excessive amounts are applied and under high rates of rain and irrigation. It is water soluble. Beef cattle feedlots of over 70,000 head in one unit raised the nitrate content of the soil 20 feet deep to a maximum of 5,000 pounds per acre. Research is defining the involvement of agriculture in the pollution problem by determining the fate of agri-chemicals applied on farm lands and the effects of animal wastes. It is also developing cropping systems and other means for stabilizing pollutants from agricultural operations.
W69-09767

5C. Effects of Pollution

POLLUTION AND EUTROPHICATION PROBLEMS OF GREAT SOUTH BAY, LONG ISLAND, NEW YORK,
New York State Dept. of Conservation, Ronkonkoma.
Jack Foehrenbach.
J Water Pollut Contr Federation, Vol 41, No 8, Part 1, p 1456-1466, Aug 1969. 11 p, 4 fig, 1 tab, 16 ref.

Descriptors: *Eutrophication, *Bays, *Farm wastes, Poultry, Water pollution sources, Water pollution effects, Dissolved oxygen, Oxygen demand, Streamflow, Sport fishing, Commercial fishing, Recreation, Ecology, Economics, Fisheries, Pesticides, Waste water disposal.
Identifiers: *Great South Bay, Long Island (NY).

Great South Bay is located midway between New York City and Montauk Point. Each year sport fisheries gross $4,539,000. In addition, 53,400 lb of finfish ($12,000) and 4,792,000 lb of shellfish ($4,250,000) are harvested. Because of poor recirculation and small inflow of tidal waters, the creek flows of 24 million cu ft/day and groundwater flows of 28 million cu ft/day are helping to increase the nutrient content of the 92-sq mile bay, much of which is less than 8 ft deep. Although the bay has a large assimilative capacity for some forms of pollution, it is reaching a point where additional loads will affect adversely its ecology, economic, and recreational value. (Knapp-USGS)
W69-09453

PHOTOSYNTHETIC OXYGEN PRODUCTION IN A POLLUTED TROPICAL ESTUARY,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
M. B. Pescod.
J Water Pollut Contr Federation, Vol 41, No 8, Part 2, p R309-R321, Aug 1969. 13 p, 11 fig, 3 tab, 11 ref. Proj No 34/3.

Descriptors: *Photosynthetic oxygen, *Reaeration, *Tropical regions, *Estuaries, *Water pollution effects, Turbidity, Oxygen demand, Nutrients, Photosynthesis, Oxygen sag, Solar radiation, Plankton, Phytoplankton, Productivity.
Identifiers: *Thailand, *Chao Phya River, Tropical estuaries.

Interference with light transmission by turbidity severely restricts phot osynthetic oxygenation in the Chao Phya River estuary in Thailand. Light and dark bottle studies indicated that oxygen production by phytoplankton was normally from 0.5 to 1.3 mg/1/day at the river surface and fell off to 0 at a depth of 1.0 to 1.5 m. Gross photosynthetic oxygen production at a heavily polluted section of the river ranged from 0.20 to 0.78 g/day/sq m, which supplied only 1.25 to 4.6% of the oxygen demand. An average rate of photosynthetic oxygen production of more than 0.014 mg/1/day should not be assumed in oxygen balance calculations for alluvial tropical rivers. (Knapp-USGS)
W69-09455

CONCEPTS OF FECAL STREPTOCOCCI IN STREAM POLLUTION,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
For primary bibliographic entry see Field 05B.
W69-09456

EFFECT OF ENVIRONMENTAL FACTORS ON BENTHAL OXYGEN UPTAKE,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering and Dow Chemical Co., Midland, Mich. Waste Treatment Div.
Archie J. McDonnell, and S. Douglas Hall.
Res supported by funds from OWRR, Dept of Interior. J Water Pollut Contr Federation, Vol 41, No 8, Part 2, p R353-R363, Aug 1969. 11 p, 7 fig, 5 tab, 20 ref. OWRR Contract 14-01-001-983.

Descriptors: *Oxygen demand, *Benthic fauna, *Benthic flora, *Decomposing organic matter, *Respiration, Biodegradation, Eutrophication, Water pollution effects, Aquatic microorganisms, Oxygen requirements, Sedimentation, Water temperature, Oxygen sag, Water quality.
Identifiers: Oxygen uptake.

The study was conducted to define the effects of oxygen concentration, temperature, and biological community on the oxygen demand of benthal deposits sampled from a mildly polluted eutrophic stream. Six-inch diam (15.2-cm) plastic cylinders were filled with benthal material from 2-, 12-, 15-, and 25-cm depths and mixed constantly in a dark environment. Results show that oxygen uptake varied according to oxygen concentration. Uptake was independent of sample depth--microbial concentration accounted for 45- to 48-percent respiration and invertebrate respiration, 52-55%. Uptake rates varied from 0.0001 to 0.0005. A two-fold biological rate increase was noted with a 10 C temperature rise. (Knapp-USGS)
W69-09457

EFFECT OF SLUDGE DEPTH ON OXYGEN UPTAKE OF A BENTHAL SYSTEM,
Perkins (Dana F.) and Sons, Inc., Reading, Mass.; and Tufts Univ., Medford, Mass.
Robert I. Davison, and N. Bruce Hanes.
Water and Sewage Works, Vol 116, No 8, p 301-306, Aug 1969. 6 p, 10 fig, 4 tab, 14 ref. Grant No 5T1-WP-40-05 (FWPCA).

Descriptors: *Oxygen demand, *Sludge, *Streams, *Water pollution effects, Biochemical oxygen demand, Biodegradation.
Identifiers: Sludge depth-oxygen demand relations.

A laboratory study was made of the effect of sludge depth on the oxidation rate of a benthal sludge deposit. The depths of sludge studied were 1.6, 15.2, and 30.5 cm in reactors each of which consisted of an annular chamber between 7 inch outside diameter and 8 3/4 inch inside diameter plexiglas cylinders, a magnetic stirrer, a thermistor, and an oxygen probe. Temperatures were controlled by running the experiments in a walk-in incubator. Experimental data are tabulated and shown graphically. Deeper sludge deposits exert a significantly greater oxygen uptake than shallower deposits. After consolidation of a sludge deposit, oxygen uptake is independent of depth. In a stream deposit, if the sludge is not agitated by stream turbulence or bubbling, depth and oxygen uptake are probably independent. (Knapp-USGS)
W69-09474

AGRICULTURE'S CONTRIBUTION TO THE FERTILIZATION OF CANAL LAKE,
Guelph Univ. (Ontario). Dept. of Soil Science.
F. R. Campbell, and L. R. Webber.
J Soil and Water Conserv, Vol 24, No 4, p 139-141, Aug 1969. 3 p, 2 fig, 2 tab, 9 ref.

Descriptors: *Eutrophication, *Nutrients, *Water pollution sources, *Agriculture, Nitrogen, Phosphorus, Fertilizers, Runoff, Farm wastes, Productivity, Aquatic plants.
Identifiers: *Canal Lake (Ontario).

Water quality, weed growth, and nutrient loadings of Canal Lake, Ontario were studied between May and November 1968. Relatively little nitrogen and phosphorus are contributed by the area's low-level agriculture. Precipitation contributes more nitrogen than streams. Agriculture contributes about 0.15 lb/acre, about a twentieth of the yield from an equivalent nonfertilized area. Most nitrogen probably comes from lake sediments, plants, and fixation of nitrogen in the lake. About 84% of the phosphorus probably originates in a lake upstream of Canal Lake. The agricultural yield is only about 63 lb from 30,000 acres. These contributions, of nutrients are negligible considering the total nutrients in the lake, the nutrient load of the streams and other sources of nutrients. (Knapp-USGS)
W69-09662

SEASONAL FLUCTUATIONS OF LAKE MICHIGAN DIATOMS,
Bureau of Commercial Fisheries, Ann Arbor, Mich.
For primary bibliographic entry see Field 02H.
W69-09679

A SURVEY OF THERMAL POWER PLANT COOLING FACILITIES,
Federal Water Pollution Control Administration, Portland, Oreg.; Washington State Water Pollution Control Commission; and Washington Office of Air Quality Control, Olympia.
Robert W. Zeller, Herbert E. Simison, E. Jack Weathersbee, Harold Patterson, and George Hansen.
Pollut Contr Counc Rep, Pacific Northwest Area, Apr 1969. 54 p, 19 fig, 1 tab.

Descriptors: *Thermal powerplants, *Cooling water, *Thermal pollution, *Surveys, Cooling, Water cooling, Cooling towers, Heated water, Industrial water, Water pollution sources, Water pollution effects.
Identifiers: Powerplant cooling waters.

A tour of 5 mine-mouth coal-fired powerplants in the eastern U.S., a gas/oil plant at Long Beach, California, and a nuclear power plant at San Clemente, California was made in 1968 to study methods of heat disposal. The information is to be used to predict impact on air and water quality of proposed powerplants in the Pacific northwestern U.S. The coal-fired plants use cooling towers and ponds because local surface water sources are inadequate in quantity for once-through cooling. The cooling towers and ponds all perform economically and satisfactorily, and cause no increased icing, precipitation or weather problems in their local areas. The coastal nuclear and gas/oil plants use once-through cooling by seawater and coastal freshwater. There are no evident water quality problems, particularly because local sport fishing is for subtropical fish which are tolerant of wide ranges of water temperature. (Knapp-USGS)
W69-09681

THE ENVIRONMENT AND PLANKTON DENSITY IN MISSOURI RIVER RESERVOIRS,
Bureau of Sport Fisheries and Wildlife, Yankton, S. Dak.
For primary bibliographic entry see Field 02H.
W69-09709

USE OF ENDOCOMMENSAL MOLLUSCAN CILIATED PROTOZOA AS INDICATORS OF WATER QUALITY AND POLLUTION IN ILLINOIS WATERS,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 05A.
W69-09718

EFFECT OF VARIOUS FACTORS ON MOVEMENT OF NITRATE NITROGEN IN SOIL PROFILES AND ON TRANSFORMATIONS OF SOIL NITROGEN,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05B.
W69-09721

EUTROPHICATION FACTORS IN NORTH CENTRAL FLORIDA LAKES,
Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
P. L. Brezonik, W. H. Morgan, E. E. Shannon, and H. D. Putnam.
Engineering Progress in Florida. Bull Series No 134 and Water Resources Research Center Pub No 5, Gainseville, Florida, Aug 1969. 101 p, 50 fig, 43 tab, 124 ref, 4 append. Grant DON 16, 010 (FWPCA). OWRR Project A-002-FLA.

Descriptors: Water quality, *Eutrophication, Algal blooms, Nutrients, Limnology, Dystrophy, Oligotrophy, *Primary productivity, *Trophic level, Water storage, Evaporation, Water circulation, Sediments.
Identifiers: Seepage losses, Diurnal variations.

A small lake in an uninhabited drainage basin in north Florida is being used as a model for the eutrophication research described in this report. An adjacent lake serves as the control. Background

data on the chemistry and biology of the lakes were obtained in order to be certain of their similarity and trophic status. Water and nutrient budgets were determined and nutrient enrichment (treated sewage effluent) has been continuous since March 1967. Both routine monitoring and special (10 day) studies were carried out in both lakes comprising the experimental system. In 1968 the research program was extended to include other lakes of various types and exhibiting varying trophic stages in North Central Florida. The eutrophic lakes in the Oklahoma chain are included. Changes in parameters have been and are continuing to be determined and related to the nutrient flux. Systems analysis techniques have been applied. Appendices include methods of chemical analyses; biological procedures, a listing of protozoa, microscopic algae and sulfur bacteria recorded from the experimental and control lakes on five dates, and the multiple regression analyses performed on ten day study data and routine monthly data.
W69-09723

GROUNDWATER POLLUTION (IN A REVIEW OF THE LITERATURE OF 1965 ON WASTE WATER AND WATER POLLUTION CONTROL),
Hawaii Univ., Honolulu. Water Resources Research Center.
Ben B. Ewing, and L. Stephen Lau.
p1-10 in Water Resources Research Center's bound volume of Collected Reprints, Vol I. Journal of the Water Pollution Control Federation, Vol 38, No 7, Jul 1966. p 1110-1117, 59 ref. OWRR Proj A-001-HI.

Descriptors: *Groundwater, *Pollution, *Literature review.

The review covers literature of groundwater pollution in the following subjects: (1) reported cases of pollution by chemical plant wastes, irrigation water, detergent, refuse dumps, fruit processing wastes, and spent pulp liquors, radioactive wastes, (2) effects on groundwater by disposal of treated sewage effluents through spreading on ground, by disposal of oil field brines by deep wells and by sewage lagooning, (3) construction of disposal well, (4) recharge basin and ground disposal systems, (5) effects on groundwater by groundwater recharge practices in California and Israel, (6) laboratory studies of travel through soils of bacteria, BOD, algae, manganese, iron, and radionuclides and of adsorption of ABS and carboxylic acids by clay and soil, (7) theoretical studies of dispersion, (8) field investigations of ABS pollution, (9) methods for site evaluations for ground disposals, and (10) legal and administrative aspects.
W69-09733

GROUNDWATER POLLUTION (IN A REVIEW OF THE LITERATURE OF 1966 ON WASTE WATER AND WATER POLLUTION CONTROL),
Hawaii Univ., Honolulu. Water Resources Research Center.
L. Stephen Lau, and Ben B. Ewing.
p 31-40 in Water Resources Research Center's bound volume of Collected Reprints, Vol I. Journal of the Water Pollution Control Federation, Vol 39, No 7, Jul 1967. p 1124-1131, 62 ref+ add ref. OWRR Proj A-001-HI.

Descriptors: *Groundwater, *Pollution, *Literature review.

The 1966 review covers literature of groundwater pollution in the following subjects: (1) ground disposal facilities, (2) geology, (3) reclamation and wastewater disposal, (4) pollutants and (5) legislation. Fifty-nine publications are cited.
W69-09734

GROUNDWATER POLLUTION (IN A REVIEW OF THE LITERATURE OF 1967 ON WASTE WATER AND WATER POLLUTION CONTROL),
Hawaii Univ., Honolulu. Water Resources Research Center.
Ben B. Ewing, and L. Stephen Lau.
p 109-117 in Water Resources Research Center's bound volume of Collected Reprints, Vol I. Journal of the Water Pollution Control Federation, Vol 40, No 6, June 1968. p 1075-1081, 56 ref. OWRR Proj A-001-HI.

Descriptors: *Groundwater, *Pollution, *Literature review.

The 1967 review covers literature of groundwater pollution in the following topics: (1) municipal sources, (2) industrial sources, (3) groundwater recharge, (4) dispersion, (5) chemistry of groundwater, (6) pollutants and (7) seawater intrusion.
W69-09735

THE STRONTIUM AND CALCIUM RELATIONSHIPS IN CLINCH AND TENNESSEE RIVER MOLLUSKS,
Oak Ridge National Lab., Tenn. Radiation Ecology Section.
D. J. Nelson.
Proc 1st Nat Symp on Radioecology, Colorado State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, Reinhold Pub Corp, NY and Amer Inst of Biological Sciences, Wash, DC, Schultz, Vincent and Klement Jr, Alfred W (eds), p 203-211, 1963. 1 fig, 8 tab, 19 ref.

Descriptors: *Strontium radioisotopes, *Calcium, *Mollusks, *Tennessee River, Clams, Growth rates, Sampling, Radioactivity, Stable isotopes, Ecosystems, Tracers, Bioindicators, Age, Flame photometry, Spectrophotometry, Fallout, Tennessee.
Identifiers: *Clinch River (Tenn), *Oak Ridge National Laboratory (Tenn), Shells, Species differences, Surface, Specific activity, Sphaeriidae, Physidae, Anodonta corpulenta, Quadrula pustulosa, Elliptio dilatatus, Elliptio crassidens, Pleurobema cordatum, Fusconaia subrotunda, Megalonaias gigantea, Actinonaias carinata gibba, Ligumea recta latissima, Lampsilis ovata, Dromus dromas, Quadrule metanevra, Amblema costata, Cyclonaias tuberculata, Plagiola lineolata, Proptera alata.

Shells of 16 species of clams were analyzed for calcium, strontium, and strontium-90 to determine content of these elements and strontium isotope as functions of species and location, and feasibility of their use as biological indicators of strontium-90. Calcium content was about 40% of ash weight; average strontium contents ranged from 156 to 382 micrograms per gram. Differing contents are due to inherent differences between species rather than to environmental ratios of strontium to calcium. Strontium content of clam shells increases with their growth rate and with reduced ratio of surface to volume. These factors do not explain strontium content of all species. Inherent species differences may be related to nonhomogeneous distribution of strontium within shells. Low-level releases of strontium-90 by Oak Ridge National Laboratory were used as tracers to determine behavior of strontium-90. On basis of dilution of Clinch River waters by the Tennessee, observed atomic ratios of strontium-90 to stable strontium agreed well with those expected in shells. This agreement suggests that clams may be useful samplers of strontium-90, and that strontium-90 released in Clinch River is in equilibrium with living and non-living components of the river system. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09741

NATURAL RADIOACTIVITY IN THE FOOD WEB OF THE BANDED SCULPIN COTTUS CAROLINAE (GILL),
Louisville Univ., Ky. Dept. of Biology.
W. L. Minckley, J. E. Craddock, and L. A. Krumholz.
Proc 1st Nat Symp on Radioecology, Colo State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, 1963, Reinhold Pub Corp, NY and Amer Inst of Biological Sciences, Wash DC, Schultz, Vincent and Klement Jr, Alfred W (Eds) p229-236. 8 fig, 4 tab, 13 ref.

Descriptors: *Sculpins, *Radioactivity, *Food webs, Kentucky, Life history studies, Gamma rays, Spectrometers, Cyanophyta, Uranium radioisotopes, Strontium radioisotopes, Cesium, Fallout, Silts, Detritus, Bottom sediments, Chutes, Eddies, Habitats, Crayfish, Growth stages, Diatoms, Algae, Metabolism, Isopods, Amphipoda, Fish, Growth rates.
Identifiers: *Cottus carolinae, Mead County (Ky), Thorium-232, Bismuth-214, Actinium-228, Swift riffles, Zirconium-95, Niobium-95, Ruthenium-106, Rhodium-106, Cerium-144, Beta radioactivity, Goniobasis, Decapoda, Plecoptera, Ephemeroptera, Tipulidae, Chironomidae, Half-life.

Consideration of life history and radioecology of banded sculpin (Cottus carolinae) reveals that most radioactivity results from natural decay; some, from fallout. Biota of the ecosystem accumulate measurable amounts. In the food web of Cottus carolinae, radioactivity concentrates at the producer level, with decreased amounts at higher trophic levels involving animals. Animals, fed mostly on diatoms and blue-green algae, generally contained the most radioactivity. Vertebrates, and larger invertebrates contained radioactivity with levels varying according to size of individual animal. Smaller animals contained more radioactive materials per unit weight than larger ones. Actual metabolic changes seem to be as important in determining amount of retention and accumulation of radiomaterials as are amounts of the radiomaterials ingested. Similarly, cumulative amounts of radioactivity taken in as food, compared with ever-increasing body burden, allow calculation of percentage of ingested radioactivity retained in the body. Percentages are relatively high during early life of sculpins, decreasing just before maturity, and increasing slowly throughout remainder of life. Lack of major variations in this level of retention indicate a certain metabolic need, or somewhat constant metabolic accumulation, which comprises approximately 2% of total radiomaterials ingested. (See also Vol 2, No 19, Field 5C, W69-07683). (Jones-Wis)
W69-09742

THE FATE OF RADIOSTRONTIUM IN A FRESHWATER COMMUNITY,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Biology and Health Physics Div.
Ivan L. Ophel.
Proc 1st Nat Symp on Radioecology, Colo State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, Reinhold Pub Corp, NY and Amer Inst of Biological Sciences, Wash, DC, Schultz, Vincent and Klement Jr, Alfred W (Eds), P 213-216, 1963. 5 fig, 2 tab, 4 ref.

Descriptors: *Strontium radioisotopes, *Freshwater, *Ecosystems, Lakes, Acidity, Calcium, Perches, Bullheads, Shiners, Otters, Muskrats, Mink, Beavers, Radioactivity, Seepage, Disposal, Tritium, Cobalt radioisotopes, Radioactive wastes, Sampling, Seasonal, Minnows, Clams, Bottom sediments, Plankton, Cesium.
Identifiers: *Chalk River (Canada), Atomic energy of Canada, Brasenis, Nymphaea, Potamogeton, Pontederia, Typha, Scirpus, Myrica, Ceratophyllum, Lepomis Procyon, Yttrium-90, Ruthenium-106, Sulfur-35, Half-life, Bone, Concentration factor.

Strontium-90 has been followed through a stream-fed ecosystem containing dissolved radionuclides from seeps in a liquid disposal area of the Canadian Atomic Energy establishment. Amounts entering Perch Lake during five years and leaving by an outlet stream were measured. Strontium-90 (Sr-90)

content in the bones of adult perch increased gradually over a four-year period, reaching equilibrium the fifth year. Most of accumulated radiostrontium is retained in the skeleton and a considerable fraction in adult fish bone is non-exchangeable. When the concentration factor for perch flesh is only five, that for bone is 3,000. Transmission of radiostrontium and radiocesium can be compared thus: for water containing the (then) maximum permissible concentration of cesium-137 (Cs-137), maximum permissible body burden of Cs-137 for man would be contained in 20 grams of fish flesh, while maximum permissible body burden of Sr-90 would be contained in 100 kilograms of perch flesh. It would seem, therefore, that the major pathway of radiostrontium--in contrast to radiocecium--to man from a contaminated body of water would be from direct use of water for drinking, rather than by way of food webs originating in the aquatic environment. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09743

RADIUM IN NATURAL WATERS IN THE UNITED STATES,
Geological Survey, Washington, D.C. Water Resources Div.
Robert C. Scott.
Proc 1st Nat Symp on Radioecology, Colo State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, Reinhold Pub Corp, NY and Amer Institute of Biological Sciences, Wash DC, Schultz, Vincent and Klement Jr, Alfred W (Eds), p 237-240, 1963. 3 fig, 7 ref.

Descriptors: *Radium radioisotopes, *Groundwater, *United States, *Radioactivity, Sampling, Aquifers, Public health, Geological surveys, Kansas, Oklahoma, Missouri, Colorado, New Mexico, Iowa, Illinois, Minnesota, Wisconsin, Michigan, Indiana, Kentucky, Freshwater, Brackish water, Deep wells, Geochemistry, Geologic formations, Shales, Uranium radioisotopes, Limestones, Sandstones, Stock water, Domestic water, North Carolina, South Carolina, Texas, Maine, New Hampshire.
Identifiers: Drinking water, Mississippi Valley, Cambrian, Ordovician, Brine water, Thorium.

Author reports on radium concentrations in groundwater exceeding, on the average, 3.3 micromicrocuries per liter and are considered anomalous. In formations of Cambrian and Ordovician age of the upper Mississippi Valley, in Iowa and Illinois, such anomalous concentrations exist. This area, underlain by high-radium water in aquifers, extends into Minnesota, Wisconsin, the northern Michigan peninsula, and across Indiana into northern Kentucky. However, samples from wells in northeastern Iowa, northern Illinois, and northward to the outcrop formations of Cambrian and Ordovician in Minnesota and Wisconsin generally contained less radium. Of the Roubidoux Formation and Cotter Dolomite of Early Ordovician age, perhaps a southward extension of the anomalous radium area of upper Mississippi Valley, in Kansas, Oklahoma, and Missouri, samples of freshwater with high radium were taken from municipal wells. High-radium water in limestones and sandstones occurs between an outcrop area receiving freshwater recharge and deeply buried parts of the aquifers containing high-radium brines. Of the Cheyenne Sandstone Member of the Purgat oire Formation of Early Cretaceacus age in southeastern Colorado and New Mexico, many wells yield water containing anomalous amounts of radium. Other high-radium areas have been found in the United States. (See also Vol 2, No 19, Field 5C W69-07863). (Jones-Wis)
W69-09744

USE OF LIGHT NUCLIDES IN LIMNOLOGY,
Yale Univ., New Haven, Conn. Geochronometric Lab.; and Yale Univ., New Haven, Conn. Dept. of Geology.
Edward S. Deevey, Jr., Minze Stuiver, and Noboyuki Nakai.
Proc 1st Nat Symp on Radioecology, Colo State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, 1963, Reinhold Pub Corp, NY and Amer Institute of Biological Sciences, Wash, DC, Schultz, Vincent and Klement Jr, Alfred W (Eds), p 471-475. 5 fig, 12 ref.

Descriptors: *Limnology, *Radioactivity, *Carbon, *Carbon radioisotopes, *Sulfur, Lakes, Hypolimnion, Ecosystems, Connecticut, Methane, Carbonate rocks, Fallout, Pondweeds, Groundwater, Mud, Fermentation, Phytoplankton, Sulfates, Rainwater, Metabolism, New York, Analytical techniques, Radioecology.
Identifiers: *Light nuclides, Nuphar, Linsley Pond (Conn), Queechy Lake (NY).

Authors' first studies on carbon in lakes resulted from a search of error in radi ocarbon dating sources. A study of carbon-13 in five lakes, differing in hardness and size, showed carbon in the hypolimnion as, at least, a three-component system: carbon dioxide from spring circulation, oxidation of seston in the water, and anaerobic fermentation in mud. Correction must be made for carbonate rock as source by distinguishing carbonate carbon from fermentation carbon by its carbon-14 content. Carbon-14 studies indicate presence of radiocarbon from nuclear detonations with seasonal fluctuation of fallout. Bomb radiocarbon enters lakes soft enough to be sensitive to labelled atmospheric carbon. Depletion of carbon-14 in deep water suggests that fermentation is active or works on mud whose average carbon is old enough, or that groundwater is similarly depleted (although the lakes are supposedly insulated from groundwater by clay basinseal). Input and distribution of sulfur-34 within lakes is much like carbon. Major source of sulfur, except where rocks are rich in sulfate, is from air as sulfur dioxide. Agricultural fertilizer, sulfur introduced as sea-spray, and industrial sulfur are not probable sources; best explanation for sulfur-enrichment is that lakes are ecosystems metabolizing sulfur. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09745

THE PRESENT STATE OF LAKE ZURICH (IN GE RMAN),
Kantonales Laboratorium, Zurich (Switzerland). Limnologische Abteilung.
For primary bibliographic entry see Field 02H.
W69-09746

THE IONIC COMPOSITION OF LAKE WATERS,
Uppsala Univ. (Sweden). Inst. of Limnology.
For primary bibliographic entry see Field 02H.
W69-09747

SEDIMENTATION IN ARTIFICIAL LAKES,
Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 02H.
W69-09748

THE CALCIUM, MAGNESIUM, POTASSIUM, AND SODIUM BUDGETS FOR A SMALL FORESTED ECOSYSTEM,
Dartmouth Coll., Hanover, N.H. Dept. of Biological Sciences.
For primary bibliographic entry see Field 02K.
W69-09750

THE CONCEPT OF PRODUCTIVITY IN BIOLOGY (GERMAN),
For primary bibliographic entry see Field 02K.
W69-09751

INCREASE IN THE CONTENT OF ORTHOPHOSPHORUS AS AN EXPRESSION OF PROGRESSIVE EUTROPHICATION OF LAKE CONSTANCE (GERMAN),
Institut fur Seenforschung und Seenbewirtschaftung Langenargen am Bodensee.
For primary bibliographic entry see Field 02H.
W69-09752

IONIC COMPOSITION OF SAGEHEN CREEK, CALIFORNIA, FOLLOWING AN ADJACENT FIRE,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition; and California Univ., Berkeley. Dept. of Zoology.
For primary bibliographic entry see Field 02K.
W69-09753

CHEMICAL INVESTIGATION OF LAKE SEDIMENTS AND THEIR INTERPRETATION,
Freshwater Biological Association, Windermere (England).
For primary bibliographic entry see Field 02H.
W69-09754

MODE OF FILAMENTOUS GROWTH OF LEUCOTHRIX MUCOR IN PURE CULTURE AND IN NATURE, AS STUDIED BY TRITIATED THYMIDINE AUTORADIOGRAPHY,
Indiana Univ., Indianapolis. Dept. of Microbiology.
Thomas D. Brock.
Journal of Bacteriology, Vol 93, No 3, p 985-990, March 1967. 3 fig, 5 tab, 11 ref.

Descriptors: *Bacteria, *Cultures, *Tritium, Epiphytology, Marine algae, Ecology, Nutrients, Seawater, Organic compounds, Habitats, Statistical methods.
Identifiers: *Leucothrix mucor, *Growth, *Filaments, *Autoradiography, Antithamnion sarniense, Tritiated glucose, Gonidia formation, Long Island Sound (NY), Iceland, Tritiated thymidine, Narragansett Bay (RI), Cape Reykjanes (Iceland), Sudurnes (Iceland), Non-parametric tests, One-Sample Runs Test, Cluster analysis, Reykjavik (Iceland).

Growth mode of Leucothrix mucor filaments was measured by autoradiography with tritiated thymidine. Studies were performed on L mucor in pure cultures in free suspension, as an epiphyte of pure culture of the red alga Antithamnion sarniense, and as an epiphyte of red algae in the sea. Statistical analyses of growing cells distribution was performed by use of the nonparametric One-Sample Runs Test and a Cluster analysis adapted from quadrat analyses of plant ecologists. No evidence of preferential growth at base or tip of L mucor filaments was obtained in any of these studies. However, in nature, but not in the laboratory, there were regions of L mucor filaments which were non-growing or dormant. Such nongrowing regions could incorporate tritiated glucose. In laboratory culture of Leucothrix on Antithamnion, Leucothrix cannot grow alone in the medium (ASP-6) in which the alga grows, but only when attached to alga. The algae seemingly released nutrients into the water where complete mixing occurs. All regions of bacterial filaments should have equal access to the nutrient supply and there should be no preferential growth at the base. In nature, epiphytic bacteria probably derive their nutrients from seawater. (Jones-Wis)
W69-09755

5D. Waste Treatment Processes

THE ROLE OF ALGAE IN DEGRADING DETERGENT SURFACE ACTIVE AGENTS,
Texas Univ., Austin. Dept. of Civil Engineering.
Ernst M. Davis, and E. F. Gloyna.
J Water Pollut Contr Federation, Vol 41, No 8, Part 1, p 1494-1504, Aug 1969. 11 p, 4 fig, 5 tab, 21 ref. Grant No NSF-GU-1963.

Descriptors: *Biodegradation, *Algae, *Aquatic bacteria, Detergents, Surfactants, Alkylbenzene sulfonates, Linear alkylate sulfonates, Water pollution effects, Stabilization, Lagoons, Toxicity, Waste water treatment, Waste water disposal.
Identifiers: *ABS, LAS.

The rates of degradation of 3 typical nonionic and 2 anionic surfactants by green and blue-green algae were evaluated. Additional data were gathered for organisms obtained from raw wastewater, activated sludge, and waste stabilization pond water. Results show that algae contribute to a small extent in the degradation of common household detergents. Most degradation is attributed to bacteria or other organisms. Algae did not degrade alkyl benzene sulfonate while bacteria did (0.45 mg/l/day). The other anionic surfactant, linear alkyl sulfonate, was degraded in small amounts by some of the different algal forms (0.97 mg/l/day by bacteria). Nonionic detergents were more easily degraded. (Knapp-USGS)
W69-09454

THE INDIRECT CYCLE OF WATER REUSE,
Stanford Univ., Calif. Dept. of Environmental Engineering.
George Tchobanoglous, and Rolf Eliassen.
Water and Wastes Eng, Vol 6, No 2, p 35-41, Feb 1969. 7 p, 8 fig, 4 tab, 26 ref.

Descriptors: *Water reuse, *Reclaimed water, *Artificial recharge, Recharge wells, Water spreading, Water quality, Water treatment, Sewage treatment, Economics, Water supply.
Identifiers: Indirect cycle reuse.

The indirect cycle may be defined as the return of water used one or more times to hydrologic and natural cycles for reuse. Treated wastewater is returned through the indirect cycle by surface spreading, direct injection, and seepage from pits and septic tank leaching fields. Technical factors that must be considered include the rate of application, the characteristics of the recharge site, quality and quantity requirements, and the availability of suitable treatment processes. The economic feasibility of the indirect reuse of reclaimed water is based on an analysis of the cost effectiveness of the treatment processes used to reclaim it, the cost of transporting and recharging it, and the cost of alternative sources of supply. In the future, the application of reclaimed water for groundwater replenishment and the control of salt water intrusion will increase as greater demands are placed on existing groundwater reserves. (Knapp-USG S)
W69-09495

INSTREAM AERATION OF POLLUTED RIVERS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 05G.
W69-09555

A SURVEY OF THERMAL POWER PLANT COOLING FACILITIES,
Federal Water Pollution Control Administration, Portland, Oreg.; Washington State Water Pollution Control Commission; and Washington Office of Air Quality Control, Olympia.
For primary bibliographic entry see Field 05C.
W69-09681

STORM DRAINAGE ASPECTS OF THE DEEP TUNNEL PLAN,
Bauer Engineering Inc., Chicago, Ill.
W. J. Bauer.
Proc AISI Seminar, Ill Inst Technol, Oct 8, 1968. 29 p, 10 fig, 5 tab.

Descriptors: *Water pollution control, *Storm runoff, *Pumped storage, *Tunnels, *Illinois, Hydroelectric power, Water storage, Costs, Cost-benefit analysis, Storm drains, Retention.
Identifiers: *Chicago deep tunnel plan.

The proposed Chicago deep tunnel plan would provide temporary storage of storm runoff from combined sewers to allow steady low-volume treatment and prevent discharge of raw sewage to surface waters. The total cost is estimated to be 242-446 million dollars. Operating costs are expected to be very low because the facility will be large enough to use profitably as a peak-demand pumped storage hydroelectric plant. Storm runoff will be only a small part of the total movement of water. The design and cost analysis of the project are described briefly. (Knapp-USGS)
W69-09690

TREATMENT AND DISPOSAL OF RADIOACTIVE WASTES,
E. Ya. Spitsyn.
Transl from Atomizdat, Moskva, 1965. 102 p, 40 fig, 15 tab, 44 ref, 1 append. Available from the Clearinghouse as TT No 68-50326, $3.00 in paper copy, $0.65 microfiche.

Descriptors: *Radioactive waste disposal, *Waste treatment, Coagulation, Ion exchange, Biodegradation, Evaporation, Underground storage, Injection wells, Safety, Waste dilution, Nuclear wastes, Waste dumps, Waste storage, Solid wastes.
Identifiers: *USSR, Radioactive waste handling.

The disposal of radioactive wastes has always received considerable attention and supervision in the USSR. Norms were introduced and basic regulations promulgated for the disposal of radioactive wastes into the atmosphere, water bodies, and into the soil. The considerable experience that has since been accumulated in the USSR in the design and construction of the necessary radioactive-waste disposal installations and structures is discussed in a textbook which includes descriptions of the techniques for the collection, processing, transportation, and burial of solid and liquid radioactive wastes. Some elementary concepts of nuclear physics, basic definitions, and terminology are given. The techniques of processing liquid and solid wastes are described and technical aspects and health hazards are discussed. Recommendations for the selection of equipment and examples of various calculations are given. The selection on 'cooling' of radioactive wastes is more detailed than the rest of the chapter since the published information on this subject is not sufficient for practical purposes. The transportation and burial techniques of radioactive wastes are described from design data as well as from data provided by the existing burial grounds for radioactive wastes. (Knapp-USGS)
W69-09717

5E. Ultimate Disposal of Wastes

TREATMENT AND DISPOSAL OF RADIOACTIVE WASTES,
For primary bibliographic entry see Field 05D.
W69-09717

5F. Water Treatment and Quality Alteration

EVOLUTION OF WATER QUALITY GOALS,
Elwood L. Bean.
Journal of the American Water Works Association, Vol 61, No 7, p 317-320, Jul 1969. 4 p, 11 ref.

Descriptors: *Water quality, *Attitudes, History, Administration, Standards, Water works, Water costs, Water quality control, Test procedures, Toxicity, Organic matter, Corrosion, Insecticides, Zeta potential, Nitrates, Nitrites, Viruses.
Identifiers: *Goals, Demand for quality, AWWA Committee on Water Quality Goals.

The article evaluates USPHS water quality standards and relates the rise of new standards. The recent work of an AWWA committee to establish higher standards emphasizes that water must be not only safe, but also clear, palatable, nonstaining and noncorrosive, and not too hard. AWWA has recommended the committee's goals to the water industry. The burden of action is on individual water suppliers, who are responsible to their consumers. Many consumers may stifle attempts for higher quality water because of the common conception of water as 'cheap.' Water works management, which has educated the public toward low cost, should reorient consumers toward quality and create a customer demand for better water. The AWWA Committee on Water Quality Goals has begun a survey to determine the field status of water quality control. Other research needs include: simpler tests to measure corrosivity, toxics and organic constituents; insecticide hazards; refined measurement of either zeta or streaming potentials; effects of minerals on health; reduction of schistosomiasis; nitrate-nitrite dangers; virus control; and improved sensors for monitoring water. (Gossen-Chicago)
W69-09564

ALTERNATIVES IN WATER SUPPLY,
Daniel A. Okun.
Journal of the American Water Works Association, Vol 61, No 5, p 215-221, May 1969. 7 p, 29 ref.

Descriptors: *Dual system, Water quality, Viruses, Chemical degradation, Aesthetics, Attitudes, Education, Pricing, Costs, Automation, Technology, Water sources, Human resources.
Identifiers: Utility tunnels, Regional administration.

After reviewing unmet PHS standards and confronting the possibilities of disease caused by public water, the author discusses three aspects of public water supplies: viruses in water; chemicals in water; and esthetic quality. The dangers of viruses and chemicals may be more far-reaching than they appear. Esthetic quality is so low that a dissatisfied public is turning more and more to bottled water. The recommended action is to establish a dual water supply. Drinking water would be of highest quality, taken from naturally pure sources or produced from brackish or seawater. The second supply might be of questionable quality and esthetically less desirable, but it would be bacteriologically safe through conventional treatment that includes disinfection. Implementation could be achieved by public education or by a discriminating pricing policy. Costs of dual supplies would not differ significantly from conventional systems. Future trends are discussed, including: utility tunnels; automation; regionalization of public water management; new water sources available through technology, and greater utilization of human resources. The article is followed by two discussions of the article: one by Samuel S. Baxter, one by Henry J. Graeser and Albert H. Halff. (Gossen-Chicago)
W69-09566

STATE LABORATORY OF HYGIENE.

N C Gen Stat secs 130-30, 130-31 (1964), as amended, (Supp 1967).

Descriptors: *North Carolina, *Administrative agencies, *Public health, *Water supply, Legislation, Regulation, Analysis, Potable water, Sanitary engineering, Water quality, Water pollution, Environmental sanitation, Microorganisms, Inspections, Water quality control.
Identifiers: Hygiene.

A State Laboratory of Hygiene under the control of the State Board of Health is established for the better protection of the public health. All public water supplies shall be examined monthly. Water supplies furnishing potable water to ten or more residences or businesses are deemed a public water supply. In addition, all waters sold in bottle or package and all spring waters maintained for human consumption shall be examined monthly by the laboratory. Any other waters shall be examined when a specimen is sent to the state laboratory by a local health director or licensed physician. When examinations indicate the presence of intestinal organisms or other evidence of contamination, notice

shall be sent to the suppliers and examinations shall then be made weekly until evidence of contamination is no longer present. (Childs-Fla)
W69-09584

5G. Water Quality Control

PESTICIDES IN SELECTED WESTERN STREAMS-A PROGRESS REPORT,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 05A.
W69-09447

LINDANE DIFFUSION IN SOILS:[1]. THEORETICAL CONSIDERATIONS AND MECHANISM OF MOVEMENT,
California Univ., Riverside. Dept. of Soils and Plant Nutrition; and Agricultural Research Service, Riverside, Calif.
For primary bibliographic entry see Field 05B.
W69-09477

LINDANE DIFFUSION IN SOILS:[2]. WATER CONTENT, BULK DENSITY, AND TEMPERATURE EFFECTS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition; and Agricultural Research Service, Riverside, Calif.
For primary bibliographic entry see Field 05B.
W69-09478

VAPOR DENSITY OF SOIL-APPLIED DIELDRIN AS RELATED TO SOIL-WATER CONTENT, TEMPERATURE, AND DIELDRIN CONCENTRATION,
California Univ., Riverside. Dept. of Soils and Plant Nutrition; and Agricultural Research Service, Riverside, Calif.
For primary bibliographic entry see Field 05B.
W69-09479

AID TO MUNICIPALITIES FOR WATER POLLUTION CONTROL.

NH Rev Stat Ann secs 149-B:1 thru 149-B:3 (1964), as amended, (Supp 1967), secs 149-B:4 thru 149-B:5 (Supp 1967).

Descriptors: *New Hampshire, *Cities, *Sewage treatment, *Water pollution, Legislation, Federal government, State governments, Cost sharing, Construction, Water pollution control, Regulation, Engineering, Treatment facilities, Sewers, Public health, Administrative agencies, Surface waters, Cost repayment, Disposal, Amortization, Installation, Maintenance, Operating costs, Grants, Legal aspects, Costs, Sewage disposal.

The state of New Hampshire shall, in addition to the federal grant, pay annually 30% of the yearly amortization charges on the original costs resulting from the acquisition and construction of sewage disposal facilities by municipalities for the control of water pollution. The approval of such construction must first be obtained from the Water Pollution Commission. Those municipalities that began construction of their facility before July 1, 1947 shall be entitled to receive their full costs retroactively. Any municipality which qualified for state contribution shall receive an additional 10% amortization from the state yearly. All pollution control facilities must be installed in accordance with specifications approved by the Water Pollution Commission, and failure to comply with such plans will result in the loss of payments to the municipality. (Shevin-Fla)
W69-09523

MARINE TOILETS AND DISPOSAL OF SEWAGE FROM BOATS.
NH Rev Stat Ann 149-A:1 thru 149-A:11 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Water pollution sources, *Boats, *Sewage disposal, Recreation, Water sports, Regulation, Transportation, Bodies of water, Water pollution, Wastes, Organic wastes, Sewage, Ships, Sewage treatment, Legislation, Legal aspects, Administrative agencies, Permits, Inspection.
Identifiers: *Marine toilets, Penalties (Civil).

No marine toilet on any boat shall be so constructed or operated as to discharge any sewage into waters of the state. Any marine toilet shall have a suitable treatment device constructed and operated in compliance with regulations of the Water Supply and Pollution Control Commission. No sewage from any toilet with a treatment device shall be discharged within 500 feet of the shoreline. Violators of this provision shall be fined. All boats located on the waters of the state shall be subject to inspection by the Commission to insure compliance with these provisions. All boats having a marine toilet must be registered with the Department of Safety. The registration certificate of any boat not properly equipped with a marine toilet as herein described shall be suspended until the discrepency is remedied. The registered owner of any boat having its registration certificate suspended shall be notified and shall have the right to a hearing on the suspension. (Helwig-Fla)
W69-09524

INSTREAM AERATION OF POLLUTED RIVERS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
W. Whipple, Jr., J. V. Hunter, B. Davidson, F. W. Dittman, and Shaw L. Yu.
Available from the New Jersey Water Resources Research Institute for $2 per copy. Water Resources Research Institute, Rutgers - The State University of New Jersey, New Brunswick, Aug 1969. 196 p, 41 tab, 56 fig, 78 ref. FWPCA 16080 DUP.

Descriptors: *Aeration, *Dissolved oxygen, *Water quality control, *BOD, *Optimization, Oxygen, Oxygen sag, Water pollution treatment, Water quality, Optimum development plans, Systems analysis.
Identifiers: *Instream aeration, *Induced aeration, *BOD mass balance, Mechanical aerator, Diffused aerators, Dynamic simulation.

Mechanical and diffuser instream aerators were tested on the Upper Passaic River and proved a practical and economical method of adding dissolved oxygen to polluted streams. The tests were conducted in conjunction with research into photosynthesis, benthal oxygen demand, and mass balance of BOD in that river system. Systems of aerators were designed to provide for meeting water quality objectives of dissolved oxygen, and cost estimates made. Alternative costs of meeting the same objectives by means of advanced effluent treatment alone appear to be several times as great. It is concluded that instream aeration may provide a feasible alternative to advanced waste treatment for polluted rivers, as a supplement to secondary waste treatment.
W69-09555

ENGINEERING APPLICATION OF MULTIVARIABLE DISTRIBUTED PARAMETER CONTROL THEORY,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For pri mary bibliographic entry see Field 06A.
W69-09559

POLLUTION AND ENVIRONMENTAL QUALITY,
Resources for the Future, Inc., Washington, D.C.
Robert U. Ayres, and Allen V. Kneese.
IN The Quality of Urban Environment: Essays on 'New Resources' in an Urban Age, p 35-71, edited by Harvey S. Perloff, Resources for the Future, Inc. The Johns Hopkins Press, Baltimore, 1969. 37 p, 7 fig, 10 tab.

Descriptors: *Management, *Planning, *Quality control, *Waste disposal, Pollution, Air pollution, Water pollution, Solid wastes, Marketing, Costs.
Identifiers: *Total environmental approach, *Environmental planning, *Environmental quality, Reprocessing, Interdependencies.

Traditionally environmental pollution has been approached in a fragmented way; air, water, and solids pollution are each dealt with separately. This discussion is organized in terms of the main sectors of the economy which produce waste, particularly urban areas, and an attempt is made to look at the waste problem in its entirety. Environmental pollution and its control is viewed as a materials balance problem for the entire economy. Detailed empirical estimates of actual discharges of residuals to the environment and a discussion of some technologies for their modification is given. Using a schematic residual materials flow for the household sector, excluding automobiles, the interdependencies of the various waste streams is shown. The point is made that our market mechanism fails to deal appropriately with the entire resources allocation problem and does not adequately reflect the costs of disposing of residuals, including any costs to the overall society associated with their discharge into the environment. Two ways of dealing with this problem are given. Both call for internalizing the problem to take account of all costs and benefits. The system to be used in reorganizing our social policy to produce different relative burdens being placed on various residual receiving environmental media is described. (Marriott-Chicago)
W69-09563

ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
Philip J. Coffey, and Leonard Ortolano.
Journal of the American Water Works Association, Vol 61, No 5, p 237-241, May 1969. 5 p, 2 fig, 2 tab, 16 ref.

Descriptors: *Water quality control, *Economic efficiency, Salinity, Project planning, Hardness (Water), Costs, Benefits, Optimization.

The article focuses on determining the degree of water quality enhancement that should be provided where salinity is the major quality indicator. Benefits are perceived as costs avoided by downstream users due to salinity reduction. The purpose of this article is to suggest a design for an economically efficient control program. Analysis is limited to the case where loads and level of water use are constant. A n analogy is made between this method and the techniques used in planning flood protection. Section I discusses special problems in mineral pollution control. Section II describes the proposed method for relating costs of salinity control to water quality. The method fulfills the economic criteria established by the President's water resources council in 1962: (1) total tangible benefits exceeding costs; (2) marginal benefits of each separable unit of a project exceeding its cost; and (3) scope of development sufficient to maximize net benefits. Section III applies the method. Section IV discusses the value and limitations of the method. It should be useful in developing a program to relieve a current condition of saline pollution. It will not give answers for situations that involve a developing basin economy. (Gossen-Chicago)
W69-09565

POLLUTION: REGULATION AND THE ANTITRUST LAWS,
Philip K. Verleger, and Jennie M. Crowley.
Nat Resources Lawyer, Vol 11, No 2, p 131-141, May 1969. 11 p, 46 ref.

Descriptors: *Air pollution, *Legislation, *Regulation, *Administrative agencies, Clean Air Act, Public health, Public rights, Pollution, Industries,

Federal government, State governments, Institutional constraints, Solvents, Judicial decisions, Legal aspects, Water pollution, Political aspects, Social aspects.
Identifiers: *Antitrust laws, Sherman Act, Clayton Act, Federal Trade Comm'n Act.

Due to the great masses of industry, the pollution problem has become acute. A number of regulatory agencies have been designed to deal with the problem. However, regulation does not gain quality when imposed without the guidance of those regulated. The author feels that the only way to a solution is through consultation between industry and government and among industries themselves. It is at this point that the problem of antitrust violations enters. Under the Sherman Act, the Clayton Act, and the Federal Trade Commission Act, any consultation among industry in relation to business practices may be subject to attack as a violation of antitrust laws. The government has refused to grant these industries immunity from prosecution, and as a result they shy away from consultation. Cases dealing with antitrust violations are studied in the article. The author feels that the right to collaborate in dealing with the government is absolute and that such collaboration is the key to pollution control. (Shevin-Fla)
W69-09577

WATER AREAS BEAUTIFICATION.
For primary bibliographic entry see Field 06E.
W69-09587

RIVERS, HARBORS.

Md Ann Code art 27 secs 482, 484, 485 (1957).

Descriptors: *Maryland, *Pollution abatement, *Riparian rights, *Mining, Legislation, Rivers, Harbors, River beds, Oysters, High water mark, Public rights, Legal aspects, Docks, Dredging, Excavation, Beds, Navigable rivers, Sands, Gravels.
Identifiers: *Public landings, Chesapeake Bay.

It is unlawful to cast or unload any ballast, ashes, filth, earth, oysters, or oyster shells from any ship or other vessel in Chesapeake Bay above 'Sandy Point' or in the waters of Herring Bay or in any river, creek, or harbor within this state below the high water mark. Damaging or destroying the usefulness of any public landing or wharf or other structure erected on said wharf is unlawful. The removal of sand, gravel, or other material from the bed of any navigable rivers, creeks, or branches of the state is unlawful. However, it is lawful for any riparian owners or their agents to dig, dredge, take and carry away sand, gravel or other materials from the bed of the river opposite the riparian land from the high water mark to the outer line of the nearest channel. (Childs-Fla)
W69-09595

POLLUTION OF SOURCES OF WATER SUPPLY.

Md Ann Code art 27 sec 583 (1957).

Descriptors: *Maryland, *Water supply, *Water pollution sources, *Pollutants, Legislation, Legal aspects, Pollution abatement, Water pollution, Wastes, Streams, Wells, Springs, Reservoirs, Water sources, Industrial wastes, Potable water, Organic wastes, Cesspools, Sewage, Water pollution control, Water quality.

The placing of any dead animal or part thereof or any decayed or filthy animal or vegetable matter in any stream, well, spring, reservoir, pond or other source of water or ice to be used for drinking or domestic purposes is unlawful. Similarly, the allowing of any sewage, washings, or other offensive matter from any privy, cesspool, factory, or other place to flow into any pipe whereby any water supply is fouled is a punishable offense. (Childs-Fla)
W69-09596

MUNICIPAL AND COUNTY GOV'T (SEWAGE SYSTEM).
Vt Stat Ann tit 24, secs 3501-3508 (1959).

Descriptors: *Vermont, *Sewage, *Sewage disposal, *Cities, Legislation, Regulation, Waste disposal, Wastes, Sewage treatment, Administrative agencies, Administrative regulations, Facilities, Local governments, Utilities, Public utilities, Taxes, Water rates.
Identifiers: Domestic sewage, Storm water, Storm sewage, Sanitary sewage, Sanitary treatment.

A municipal corporation may construct, maintain, and operate a sewage system and is authorized to purchase or acquire necessary real estate and easements. The municipal corporation may contract to make disposal of domestic or storm water sewage. The property owner using the sewage system shall be liable for rent, such rent being a lien on the real estate furnished with the service. The municipal corporation may purchase and hold realty and personalty and may levy and collect taxes necessary for the payment of the expenses and indebtedness of such sewage system. A board of sewage systems commissioners is created to supervise the municipal systems and to establish all needed rates for rent, with rules and regulations for its control and operation. (Moulder-Fla)
W69-09618

MAKING DRAINS, ROADS OR RAILROADS.

Ill Ann Stat ch 94, sec 1 (Smith-Hurd 1950).

Descriptors: *Illinois, *Ditches, *Mine drainage, *Eminent domain, Mining, Drainage, Water conveyance, Land tenure, Legislation, Legal aspects, Mine water, Mine wastes, Conveyance structures.

If a mine cannot be conveniently worked without a ditch which must necessarily pass through land owned and occupied by others to drain or convey water, the mine owner may resort to the law of eminent domain to construct the ditch upon such land. (Breeze-Fla)
W69-09622

BRADY V SPRINGDALE (CONDEMNATION ACTION FOR DESTRUCTION OF SPRINGS).
441 SW 2d 81-84 (Ark 1969).

Descriptors: *Arkansas, *Condemnation, *Springs, *Sewage disposal, Legal aspects, Judicial decisions, Condemnation value, Air pollution, Sewage, Sewage treatment, Easements, Eminent domain, Sewers, Cities, Pipes, Water pollution, Water pollution effects, Air pollution effects, Spring waters, Damages, Land tenure, Underground, Contracts, Tiles, Engineering structures, Waterworks, Odors.

Defendant condemned a permanent easement through plaintiff's land and plaintiff brought this action to recover damages for diminished value of the remaining land. Plaintiff claimed a reduction in the value of his land due to destruction of a spring and air pollution over his property from defendant's sewage disposal facility. A jury trial resulted in an award of $750 as compensation for the easement. Plaintiff appealed seeking a new trial. The court held that the jury's verdict would not be disturbed unless it was clearly erroneous. The court found that the testimony at the trial was conflicting both as to the nature of the spring which was allegedly destroyed, and as to the offensiveness of the odor from the sewage plant. The court held that in view of this conflicting evidence, the jury was justified in reaching its conclusion and the verdict was affirmed. (Shevin-Fla)
W69-09625

WATER POLLUTION CONTROL.
Iowa Code Ann secs 455B.1 to 455B.28 (Supp 1969).

Descriptors: *Iowa, *Water pollution control, *Water quality control, *Standards, Legislation, Administrative agencies, Water quality, Impaired water quality, Project planning, Legal aspects, Permits, Waste disposal, Sewage disposal, Regulation, Water conservation, Water resources development.

Iowa public policy is to conserve state waters and to protect, maintain, and improve the quality thereof; to prevent the discharge of inadequately treated waste; to provide for the control of water pollution; and to cooperate with state and federal agencies toward these objectives. The Iowa Water Pollution Control Commission is created with the powers and duties: (1) to supervise and enforce all laws relating to water pollution; (2) to develop comprehensive programs for water pollution control; (3) to cause the state Department of Health to conduct investigations; (4) to establish water quality standards; (5) to require the filling of disposal systems plans for approval or disapproval; (6) to direct the regulation of permits relating to waste or sewerage discharge and installation of disposal systems; and (7) to hold hearings. In establishing quality standards, the Commission should consider the public health, the nature of the water, the character and use of the adjacent land, the past, present and potential uses of the water, the extent of natural contamination, and the extent to which solids bacteria, organisms, toxic substances, and oxygen demanding substances should be permitted. (Marsee-Fla)
W69-09631

DRAINAGE OF COAL AND MINERAL LANDS AND MINES.
Iowa Code Ann secs 468.1 to 468.9 (1949).

Descriptors: *Iowa, *Surface drainage, *Mine drainage, *Compensation, Payment, Exploitation, Land tenure, Mineral industry, Coal mines, Eminent domain, Right-of-way, Condemnation, Legislation, Relative rights, Drainage programs.

Any person or corporation owning or possessing land underlaid with coal which cannot be mined due to an accumulation of surface water, may drain the water over the surface of land belonging to another upon agreement or judicial determination by condemnation of the damages to be paid for such drainage. Any person or corporation which in any way removes water from lead or zinc bearing lands to make them productive, shall receive on demand 1/10 of any lead or zinc removed therefrom. The person entitled to 1/10 of the minerals may examine the mines and premises of the owner, and if the owner at any time obstructs the exercise of the right to 1/10 of the minerals, a double recovery shall be allowed. Any person holding a 1/10 drainage compensation right may garnishee minerals from smelters upon notice. Any person or corporation engaged in draining lead or zinc bearing lands may obtain necessary rights of way in order to convey water from the land, with damages determined by agreement or judicially through eminent domain. No landowner is compelled by this chapter to remove minerals from his land. (Harris-Fla)
W69-09636

PUBLIC HEALTH AND SAFETY.
Ark Stat Ann sec 41-3301 (1964).

Descriptors: *Arkansas, *Animals, Public health, Streams, Bodies of water, Legislation, Water law, Pollution, Water pollution, Water pollution sources.
Identifiers: *Penalties (Criminal), Misdemeanor.

The throwing or dragging of dead or dying animals into any running stream or other body of water in the state of Arkansas is unlawful. Violation of this act is punishable by fine. (Holt-Fla)
W69-09646

WATER POLLUTION IN REMOTE RECREATIONAL AREAS,
Forest Service (USDA), Duluth, Minn. Superior National Forest.
Michael A. Barton.
J Soil and Water Conserv, Vol 24, No 4, p 132-134, Aug 1969. 3 p, 4 photo, 1 tab, 7 ref.

Descriptors: *Water pollution control, *Recreation wastes, Waste disposal, Nutrients, Sediments, Water pollution sources, Pesticides.
Identifiers: *Wilderness areas.

Continued population expansion and increased leisure time and affluence will require that wilderness areas absorb greater and greater use. These areas must be protected if they are to survive. Too often wilderness environments are ecologically delicate. Using standards of clean water normally considered appropriate in water quality control programs, wilderness waters could be degraded significantly before uses other than recreation would be damaged. Little consideration is given to nutrient enrichment in formulating standards. Greater emphasis must be accorded nutrients, the aquatic growths they produce, and the impact nutrients have on aesthetic qualities. Special standards must be formulated and strictly enforced in wilderness areas. (Knapp-USGS)
W69-09661

GROUNDWATER APPRAISAL OF THE LITTLE WABASH BASIN ABOVE THE GAGE BELOW CLAY CITY AND THE LOUISVILLE RESERVOIR SITE, ILLINOIS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09693

THE MILWAUKEE RIVER,
Milwaukee River Technical Study Committee, Wis.
For primary bibliographic entry see Field 06B.
W69-09703

QUALITY OF SURFACE WATER IN ILLINOIS, 1956-1966,
Illinois State Water Survey, Urbana. Water Supply Div.
For primary bibliographic entry see Field 02E.
W69-09739

EFFECT OF RECREATION ON WATER QUALITY,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
Irvin C. Reigner.
Univ. Mass. Coop. Ext. Serv. Pub. 446: 49-55, 1966. (Municipal Watershed Management Symposium Proceedings, 1965).

Descriptors: *Watershed management, *Recreation, *Water quality, Recreation demand, Fishing, Boating, Camping, Swimming, Aesthetics, Land use, Multiple-purpose projects, Recreation facilities, Reservoirs, Golf courses, Northeast U.S., New England.

Although forested municipal watersheds in the Northeast offer possibilities for both land and water recreation, their use has been limited by the necessity to protect water quality. Reviewing the impact of various kinds of recreation on water quality leads to the conclusion that, while recreation has not seriously degraded public water supplies, this has only been due to the determined effects of municipal authorities to prohibit or minimize recreation on watersheds and reservoirs. Increasing pressures for recreation may be met by assigning a recreation specialist to the staff of the water supply administrator. More research is needed both in the detection and treatment of pollutants, in the location of recreational facilities, and the control of recreationists; this review of current conditions helps set the stage for future research.
W69-09762

POLLUTION OF WATER FROM AGRICULTURAL SOURCES,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 05B.
W69-09767

ECONOMIC INCENTIVES AND WATER QUALITY MANAGEMENT PROGRAMS,
Wisconsin Univ., Madison.
Ved Prakash, and R. H. Morgan, Jr.
Univ of Wisconsin, Water Resources Center, Report, May 1969. 74 p.

Descriptors: *Tax incentives, *Effluent charges, *Regional systems, *Efficiency, Federal government, Wisconsin, Sewage service charges, Optimal water quality.
Identifiers: *Economic incentives, Wisconsin.

Alternative programs for water quality management are examined from efficiency, equity and financing viewpoints. The programs examined include various direct regulatory policies, tax incentives, investment credits and loan programs, effluent charges and regional systems. Both Federal and Wisconsin fiscal incentives are analyzed as to their effect on the behavior of waste producers. Effluent charges and the problem of their implementation are discussed. A review of sewage service charges is used as a background for regional water quality systems employing joint treatment facilities. Effluent charges are also discussed as a method of financing joint facilities using either marginal or average pricing schemes.
W69-09769

DAMAGE TO WATER, FLOOD CONTROL STRUCTURES, OR FISH.

Ark Stat Ann secs 4-4401 thru 4-4419 (1964), as amended, (Supp 1967).

Descriptors: *Arkansas, *Pollution abatement, *Alteration of flow, *Obstruction to flow, Mississippi River, Pollutants, Water pollution, Poisons, Fish, Fish barriers, Fish conservation, Dams, Check structures, Levees, Drains, Overflow, Embankments, Shore protection, Rivers, Streams, Bridges, Navigable rivers, Legislation, Legal aspects.
Identifiers: *Natural drains, Injunctions (Prohibitory), Penalties (Criminal).

It is unlawful to obstruct in any manner any natural drain, but this provision does not apply in certain enumerated counties. It is also unlawful to fail to keep any dam open to the extent necessary to permit a flow of water sufficient to maintain fish life in the stream below such dam. It is unlawful to poison any lake or stream. Any person who wilfully injures any structure erected to create hydraulic power to prevent the overflow of lands is guilty of a misdemeanor, but such injury to a public levee is a felony. Any person who attempts to change the course of the Mississippi River is guilty of a felony, and provision is made for injoining such an attempt. It is made unlawful to remove gravel from the beds and bars of the White River. It is likewise unlawful to leave timber in any navigable stream. (Keith-Fla)
W69-09782

RECREATIONAL ACTIVITIES NEAR WATER SUPPLY.

Ark Stat Ann secs 19-4232, 19-4233, 19-4234 thru 19-4236, 19-4238.2, 19-4271 (1968).

Descriptors: *Arkansas, *Recreation, *Water supply, *Water resources, Water pollution, Water quality, Water policy, Public health, Water utilization, Water pollution control, Waterworks, Nonconsumptive use, Natural use, Competing uses, Camping, Swimming, Water sports, Legislation, Legal aspects, Administrative agencies, Leases, Construction, Reservoirs.

The operating authority of any municipally-owned waterworks which maintains adequate pollution control may permit recreational activities upon the lands and waters maintained for waterworks purposes. The authority may construct recreational facilities, collect fees and rentals, and prescribe rules and regulations governing recreational activities. The rules shall have the force of law within the operating authority's jurisdiction, but are subordinate to those of the Game and Fish Commission in the area of hunting and fishing. Wading or swimming is prohibited in certain lakes, reservoirs and nonnavigable streams above a water intake or an impounding dam used by a municipality for water supply. Camping on non-federal land within drainage areas for reservoirs, lakes or non-navigable streams from which the water supply is taken is prohibited. The operating authority may lease land for recreational purposes and may allow construction of recreational facilities. The Board of Health may enjoin the operating authority from permitting recreational activities if the water supply is not being adequately protected from pollution. All municipalities may permit construction or relocation of waterworks or sewers by the United States in connection with flood control or other projects. (Kelly-Fla)
W69-09789

NORBECK VILLAGE JOINT VENTURE V MONTGOMERY COUNTY COUNCIL (ZONING AS WATERSHED MANAGEMENT).
254 A2d 700-706 (Md 1969).

Descriptors: *Maryland, *Zoning, *Polutants, *Watershed management, Legal aspects, Judicial decisions, Regulation, Urbanization, Local governments, Administrative agencies, Sewers, Pollution abatement, Sewage, Sewage treatment, Water pollution sources, Waste treatment, Sewage disposal, Basins, Watersheds (Basins), Water pollution, Water pollution control, Public health.

Plaintiffs were landowners in Montgomery County who desired their land to be zoned as a high density residential area. Defendant County Council had filed a master zoning plan which called for plaintiffs' land to be zoned as a low density residential area. The stated purposes of defendant's master plan were the preservation of open spaces and protection of the watershed area from pollution caused by inadequate sewage processing facilities. The court noted that the test of the validity of a comprehensive rezoning is whether it bears a substantial relationship to the public health, comfort, safety, convenience, and general welfare. The court found that defendant's master plan met the test of validity and held for the defendant. (Keith-Fla)
W69-09791

STATE JUDICIAL DETERMINATION OF RIGHTS RELATIVE TO DIFFUSED SURFACE WATERS, NATURAL GROUND WATERS, ARTIFICIAL WATERCOURSES, AND OTHER COMMON LAW PRINCIPLES,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W69-09796

ASPECTS OF STATE STATUTES I,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W69-09797

POISONING OR CONTAMINATING WATER.

Md Ann Code art 27 sec 451 (1957).

Descriptors: *Maryland, *Poisons, *Water pollution sources, Legislation, Bodies of water, Potable water, Hazards, Public health, Bacteria, Water supply, Water pollution, Water pollution control, Regulation, Water quality.

Identifiers: Penalties (Criminal).

Every person who knowingly and willfully poisons, defiles or in any way corrupts or contaminates the waters of any body of water or source of water supply usable for drinking or domestic purposes by means of disease germs, bacteria, or any other poisonous matter shall be quilty of a felony and subject to not more than 20 years imprisonment. (Childs-Fla)
W69-09803

WATER POLLUTION CONTROL COMPACT.

Vt Stat Ann tit 10, secs 1051-1053 (1958), as amended, (Supp 1968).

Descriptors: *Vermont, *Interstate compacts, *Water pollution control, *New England Interstate WPS Compact, Interstate commissions, Water pollution, Legislation, Interstate rivers, New England, New York, Compacts, Water law, Bodies of water, Legal aspects, Appropriation, Cost sharing.

The governor is authorized and directed to execute a compact, as set forth in sections 991-1002 of this title, with any of the New England states or with New York. Within 30 days after execution, he shall appoint 3 persons to serve as commissioners to the New England Interstate Water Pollution Control Commission. The commissioner of water resources and the commissioner of health shall serve as ex officio members thereon. The commissioners shall have the powers and duties as set forth in the compact. Funds are appropriated for the purposes of the Commission. (Helwig-Fla)
W69-09804

WATER POLLUTION CONTROL COMPACT.
NH Rev Stat Ann secs 488:1 thru 488:5 (1968).

Descriptors: *Water pollution, *Interstate compacts, *Water pollution control, *New Hampshire, Connecticut, Maine, Massachusetts, Rhode Island, Vermont, Legislation, Regulation, State governments, State jurisdiction, Public benefit, Administrative agencies, Legal aspects, Water policy, Water quality control, New England Interstate WPS Compact, New England, Interstate commissions.

The Water Supply and Pollution Control Commission is authorized to enter into the New England Interstate Water Pollution Control Compact with any one or more of the states of Maine, Vermont, Rhode Island, Connecticut, New York, Massachusetts. This compact concerns the abatement of existing pollution and the control of future pollution in the interstate waters of New England. The states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont agree that the provisions of the compact shall apply to streams, ponds, and lakes which are contiguous to two or more signatory states, which flow through two or more signatory states, or which have a tributary contiguous to two or more signatory states, and such provisions shall also apply to tidal waters ebbing and flowing past the boundaries of two states. The New England Interstate Water Pollution Control Commission is established. The powers, duties, and jurisdiction of the Commission are enumerated by the Compact. Procedures to be followed in entering into the Compact are presented as are the qualifications for the commissioners. (Moulder-Fla)
W69-09806

WATER POLLUTION CONTROL COMPACT.
NH Rev Stat Ann secs 488:1 thru 488:1 (V) (1968).

Descriptors: *Interstate compacts, *Water pollution, *Water pollution control, *New Hampshire, New England, Vermont, Massachusetts, Maine, Rhode Island, Connecticut, New York, Legislation, Regulation, Water law, State governments, Public benefits, Public rights, Administrative agencies, Water policy, Public health, Interstate, Interstate commissions, New England Interstate WPS Compact.

The Water Supply and Pollution Control Commission is authorized to enter into a compact with any one or more of the New England states plus New York, under the provisions of the New England Interstate Water Pollution Control Compact. It is agreed between the signatory states that the provisions of the Compact shall apply to streams, ponds, and lakes which are contiguous to two or more signatory states, which flow through two or more signatory states, or which have a tributary contiguous to two or more signatory states, and such provisions shall also apply to tidal waters ebbing and flowing past the boundaries of two states. The Commission, a body corporate and politic, shall consist of five commissioners from each signatory state. These members shall represent the state health department, the state water pollution control board, municipal interests, industrial interests, and an agency acting for fisheries or conservation. For any action of the Commission to impose an obligation on member states, a majority of the members from each signatory state must vote in favor thereof. (Moulder-Fla)
W69-09807

WATER POLLUTION CONTROL COMPACT.
NH Rev Stat Ann secs 488:1 (d)-488:2 (1968).

Descriptors: *New Hampshire, *Water quality control, *Administrative agencies, *Water pollution control, Legislation, New England, Sewage, Waste treatment, Industrial waste, Water quality, Water pollution, State jurisdiction, Recreation, Waste disposal, Systematics, Shellfish, New England Interstate WPS Compact, Standards, Water policy, Interstate commissions.

No single standard of sewage and waste treatment is considered practical, and the degree of treatment of sewage in industrial wastes should take into account the classification of the receiving waters according to present and proposed highest use. The commission establishes reasonable physical, chemical, and bacteriological standards of water quality satisfactory for various classifications of use. Each signatory state pledges to provide for the abatement of existing pollution and for the control of future pollution of interstate inland and tidal waters; however, nothing in this compact should be construed to repeal or prevent the enactment of any legislation imposing any additional condition or restriction to further lessen the pollution of waters within each state's jurisdiction. The signatory states also agree to appropriate for expenses such sums as shall be recommended by the commission, and each state with the exception of New York shall set limits on the amounts to be obligated. The compact is effective immediately upon adoption by any two contiguous states of New England but only insofar as it applies to those states and upon approval by federal law. (Moulder-Fla)
W69-09808

WATER POLLUTION CONTROL COMPACT.
NH Rev Stat Ann secs 488:2 thru 488:5 (1962).

Descriptors: *Federal government, *State governments, *Administrative agencies, *New Hampshire, New England, Legislation, Administration, Legal aspects, Regulation, Water policy, Interstate, Interstate commissions.

Whenever the State Water Supply and Pollution Control Commission enters into a compact with the duly authorized agency of any of the New England states and New York, it shall file a certified copy in the office of the secretary of state and shall notify the governor of its action. Such compact shall thereupon become effective and operative as between New Hampshire and such other state or states, subject to the consent of the Congress of the United States. After the compact becomes effective, the governor shall appoint five persons to serve as commissioners to the New England Interstate Water Pollution Control Commission. One of the commissioners must be an employee of the State Water Supply and Pollution Control Commission, and the other four shall be appointed from the membership of the New Hampshire Water Supply and Pollution Control Commission. (Moulder-Fla)
W69-09809

PUBLIC HEALTH (DRAINAGE, PUBLIC POOLS AND BATHING PLACES).
NH Rev Stat Ann sec 147:14 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Regulation, *Drainage, Legislation, Cesspools, Septic tanks, Recreation facilities, Drainage practices, Drainage programs, Controlled drainage, Drainage systems, Drainage water, Drainage engineering.
Identifiers: Penalties (Civil).

No person shall deposit any drainage from a privy, toilet, cesspool or septic tank within the limits of any public highway if such discharge enters or passes through any open highway ditch. All violations are to be reported to the state or local health authorities. A penalty, after notice, of not more than ten dollars a day is provided. (Moulder-Fla)
W69-09812

SANITARY WATER BOARD.

Ill Ann Stat ch 19, secs 145.1-145.18 (Smith-Hurd 1963), as amended, (Supp 1969).

Descriptors: *Water pollution, *Pollution abatement, *Illinois, *Waste disposal, Municipal wastes, Domestic wastes, Industrial wastes, Wastes, Sewage, Sewage disposal, Pollutants, Water pollution sources, Water pollution control, Permits, Legal aspects, Legislation, State governments, Standards, Water quality control, Administrative agencies, Regulation, Planning.
Identifiers: Injunctions (Prohibitory).

For public protection the state will maintain standards of purity in its waters consistent with their use for domestic and industrial water supplies and will regulate discharge of wastes. The statute creates the Sanitary Water Board to carry out the purposes of the act. The Board determines if pollution exists in any given body of water and is empowered to require discontinuance of pollution through its own orders or through court action. The board may issue or withhold permits to discharge wastes or sewage, may require submission of plans and specifications for new sewage works, and may develop a comprehensive plan of pollution control. The statute outlines procedure for enforcement of board orders. Draining or dumping pollutants into the waters of the state is expressly prohibited unless a permit is properly secured. Permits are also required for increasing amounts of pollutant drainage. Fines are imposed for violations, and injunctive relief is available through action by the attorney general. The act is not designed to alter acts pertaining to oil, gas, and coal resources, nor does it interfere with existing sanitary district operations. (Kelly-Fla)
W69-09822

OHIO RIVER VALLEY WATER SANITATION.

Ill Ann Stat ch 111 1/2 secs 117-121 (Smith-Hurd 1966).

Descriptors: *Illinois, *Water pollution control, *Interstate commissions, *Interstate compacts, Environmental sanitation, United States, Indiana, Kentucky, New York, Ohio, Pennsylvania, Tennessee, West Virginia, Virginia, Legislation, Ohio River, Interstate rivers, Water quality control, Industrial wastes, Sewage.

The Ohio River Valley Water Sanitation Compact between Illinois, Indiana, Kentucky, New York,

Ohio, Pennsylvania, Tennessee, and West Virginia is enacted into law. The compact provides that the signatory states from a common agency to control pollution of the Ohio River basin by creating a sanitation district which includes any water flowing into the Ohio River. The Ohio River Valley Water Sanitation Commission is provided for and is composed of three members from each member state and three from the United States government. The purpose of the compact is to keep pollution from sewage or industrial waste from harming interstate waters and public health. The Commission is empowered to make rules for regulation and sanitation, to study and report upon the pollution problems, and to make recommendations to the various states, communities and corporations with regard to such improvements. The Commission, after notice and hearing, may issue orders to those violators of these rules, and such orders are enforceable in any United States district court located in any signatory state. (Darragh-Fla)
W69-09836

WATER AND AIR POLLUTION CONTROL.
Ark Stat Ann secs 82-1901 thru 82-1903 (Supp 1967).

Descriptors: *Arkansas, *Air pollution, *Water pollution control, *Administrative agencies, Water pollution, Legislation, Sewage, Sewers, Treatment facilities, Discharge (Water), Industrial wastes, Environmental sanitation.

For purposes of this act sewage, industrial waste, pollution, sewer system, treatment works, disposal system, waters of the state, and discharge into the waters of the state are defined. The Arkansas Pollution Control Commission is created and is authorized to call upon and receive the assistance of any state educational institution, experiment station, or any state agency, and to require the furnishing of any reasonable assistance deemed necessary or beneficial to the Commission in carrying out the provisions of this act. (Marsee-Fla)
W69-09844

WATER AND AIR POLLUTION CONTROL.
Ark Stat Ann secs 82-1904 thru 82-1909 (Supp 1967).

Descriptors: *Arkansas, *Water pollution control, *Administrative agencies, *Water quality control, Legislation, Sewage, Sewage disposal, Wastes, Waste disposal, Disposal, Permits, Abatement, Impaired water quality, Pollution abatement, Treatment facilities, Water conservation, Standards, Planning, Regulation, Interstate.

The Arkansas Pollution Control Commission is charged with the following powers and duties: (1) to administer and enforce all laws and regulations relating to water pollution; (2) to conduct investigations and surveys and to classify state waters; (3) to establish water quality and pollution standards; (4) to prepare a comprehensive program for water pollution elimination or reduction; (5) to regulate the discharge of sewage or waste and control the issuance of permits therefor; (6) to regulate the construction and modification of disposal systems; (7) to conduct investigations and hearings; (8) to act as the State Water Pollution Agency for purposes of the Federal Water Pollution Control Act; (9) to require information from persons operating disposal systems, to enter property and to examine books and records; (10) to cooperate with other state and federal agencies; (11) to accept money and property; and (12) to enter into agreements with other states. Any action causing, or likely to cause, pollution is declared a public nuisance. A permit is necessary: to discharge sewage or waste into state waters; to establish facilities, outlets or disposal systems therefore; or to increase any sewage or waste. (Marsee-Fla)
W69-09845

SEWAGE DISPOSAL.
Ill Ann Stat ch 42, secs 306, 306.1, 306.2, 306.3, 307 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Sewage disposal, *Sewage treatment, *Drainage, Administrative agencies, Legislation, Legal aspects, Water law, Water policy, Sewage districts, Sewage treatment, Governments, Local governments, Administration, Regulation, Financing, Water pollution control, Water purification, Public health, Water quality control, Condemnation, Operation and maintenance, Assessments, Construction, Industrial wastes.

Sewage disposal (including industrial sewage) is the responsibility of the board of trustees of all sanitary districts. These districts must attempt to preserve their water supply from contamination. For this purpose they may construct necessary enclosed conduits and pipes. The board is also responsible for drainage within the district and must supply necessary drains, ditches, channels and outlets for this purpose. Treatment and purification of sewage when same shall flow into any lake or watercourse falls within the board's spectrum of duties. When disposal of industrial wastes cause an increased economic burden the board may levy an assessment against the producer thereof to pay the excess costs. The district is responsible for the various aspects related to operation of a sewage system including: acquisition and maintenance; coordination and control of interconnections with tributary sewer systems; and fees for inspection prior to connection with the system. The district acquires property by purchase, condemnation or otherwise as required for its corporate purposes. Compensation to landowners for such property may be in gross sum or in annual rental payments. (Johnson-Fla)
W69-09877

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

THE LINEAR DECISION RULE IN RESERVOIR MANAGEMENT AND DESIGN. I. DEVELOPMENT OF THE STOCHASTIC M ODEL,
Johns Hopkins Univ., Baltimore, Md.; and Geological Survey, Washington, D.C.
Charles Revelle, Erhard Joeres, and William Kirby.
Water Resources Res, Vol 5, No 4, p 767-777, Aug 1969. 11 p, 2 tab, 9 ref.

Descriptors: *Reservoir design, *Reservoir operation, *Water management (Applied), *Optimization, *Systems analysis, Stochastic processes, Model studies, Statistical models, Linear programming, Markov processes, Dynamic programming, Decision making.
Identifiers: Reservoir operation models, Stochastic models.

With the aid of a linear decision rule, reservoir management and design problems often can be formulated as easily solved linear programming problems. The linear decision rule specifies the release during any period of reservoir operation as the difference between the storage at the beginning of the period and a decision parameter for the period. The decision parameters for the entire study horizon are determined by solving the linear programming problem. Problems may be formulated in either the deterministic or the stochastic environment. (Knapp-USGS)
W69-09459

ON THE RANDOM OCCURRENCE OF MAJOR FLOODS,
Geological Survey, Arlington, Va.
William Kirby.
Water Resources Res, Vol 5, No 4, p 778-784, Aug 1969. 7 p, 4 fig, 6 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Probability, Model studies, Statistical models, Hydrograph analysis, Rainfall-runoff relationships.
Identifiers: Poisson flood forecasting models, Recurrence intervals.

Plausible hydrologic arguments imply that floods can be represented as the successes or exceedances in a sequence of randomly spaced Bernaulli trials representing the occurrence of hydrograph peaks. This representation generalizes existing flood occurrence models by admitting an arbitrary probability distribution of the times between trials and an arbitrary criterion for distinguishing between floods and ordinary hydrograph peaks. Analysis of this model shows that at sufficiently small exceedance probabilities the probability distributions and moments of the interexceedance time, the waiting time to the next exceedance, and the number of exceedances approach those implied by the occurrence of trials in a Poisson process. This theory therefore constitutes a rational justification of Poisson models of flood occurrence as well as a rational explanation of empiric observations. (Knapp-USGS)
W69-09460

A NOTE ON MORAN'S PROBABILITY THEORY OF DAMS AND STORAGE SYSTEMS,
City Univ., London (England).
For primary bibliographic entry see Field 04A.
W69-09470

OPTIMIZATION OF A CLASS OF RIVER AERATION PROBLEMS BY THE USE OF MULTIVARIABLE DISTRIBUTED PARAMETER CONTROL THEORY,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
V. J. Tarassov, H. J. Perlis, and B. Davidson.
Water Resources Research, Vol 5, No 3, p 563-573, Jun 1969. 11 p, 2 tab, 9 fig, 18 ref. OWRR Project A-017-NJ.

Descriptors: *Optimization, *Control theory, *Mathematical studies, Optimum development plans, Water pollution.
Identifiers: *Distributed parameter, *Control theory, Multivariable control theory, Measurement policy.

Multivariable distributed parameter control theory has been applied to the optimization of artificial instream aeration of polluted rivers. The optimization was developed for a general integral type of cost functional with weighted energy constraints. Three specific types of aeration control policies were considered: distributed space and time control, distributed time control and distributed space control. Employing typical hydrologic coefficients with the transient version of Streeter-Phelps equation, the optimal aeration control surfaces obtained were all found to lie well within the operating characteristics of commercial aeration equipment. Distributed parameter control theory applied to water pollution systems proved to be a powerful mathematical programming method comparable to linear and dynamic programming. (Whipple-Rutgers)
W69-09558

ENGINEERING APPLICATION OF MULTIVARIABLE DISTRIBUTED PARAMETER CONTROL THEORY,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
H. J. Perlis, and Burton Davidson.
Technical Research Project Completion and Termination Report, College of Engineering, Rutgers - The State University of New Jersey, Sept 1969. 8 p, 6 ref. OWRR Project A-017-NJ.

Descriptors: Water pollution, *Optimization, Planning, *Mathematical studies, Aeration.

Identifiers: Distributed parameter, *Control theory, Measurement policy, Multivariable control theory, Optimum development plans.

Multivariable distributed parameter control theory has been applied to the optimization of artificial in-stream aeration of polluted rivers. The optimization was developed for a general integral type of cost functional with weighted energy constraints. Three specific types of aeration control policies were considered: distributed space and time control, distributed time control, and distributed space control. Employing typical hydrological coefficients with the transient version of Streeter-Phelps equation, the optimal aeration control surfaces obtained were all found to lie well within the operating characteristics of commercial aeration equipment. Distributed parameter control theory applied to water pollution systems proved to be a powerful mathematical programming method comparable to linear and dynamic programming. As an adjunct to the distributed parameter optimization part of the research, an investigation of the optimal measurement policy for distributed parameter systems was undertaken. Using the transient version of the Streeter-Phelps equations, a measurement policy was formulated to minimize the integral of the mean-square value of the error resulting from the difference between the nominal dissolved oxygen and actual dissolved oxygen profiles subject to measurement cost constraints. (Whipple-Rutgers)
W69-09559

ROLE OF STATE GOVERNMENTS IN U. S. WATER MANAGEMENT,
For primary bibliographic entry see Field 06E.
W69-09581

ON OBJECTIVE APPROACH TO DE FINITIONS AND INVESTIGATIONS OF CONTINENTAL HYDROLOGIC DROUGHTS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W69-09704

THE WATER RESOURCES AND WATER RESOURCES PLANNING IN GEORGIA,
Georgia Univ., Athens. Dept. of Agricultural Economics.
Ronald M. North.
National Science Foundation Summer Short Course on Water Resources, New Mexico State University, Las Cruces, N Mex, June 1969. 37 p, 4 fig, 11 ref. OWRR Proj B-011-GA.

Descriptors: *Water resources, *Resource planning, *Long-term planning, *Water resources development, *Georgia, Economics, Social needs, Water quality, Decision making, Methodology, Project planning, River Basin development.

A history of Georgia's water resources is presented from Colonial times to the present including a discussion of the social and economic aspects of the water resources development. Water resources uses and problems are discussed. The need for a State water plan and the development of a cognitive planning process to prevent oversight of certain water resources planning needs is discussed. A summary of water resources development and use in Georgia is presented. The planning objectives, the planning process, planning strategies, and planning tactics for planning, using, and conserving Georgia's natural human and capital resources are presented together with a synoptic outline for inventories of the resources. The paper contains a summary and has 11 bibliographical references. (Conway-Ga Inst of Tech)
W69-09728

STOCHASTIC PROGRAMMING: A SURVEY,
Wisconsin Univ., Madison.
Charles E. McQuillam.
Univ of Wisconsin, Water Resources Center, Technical, Report, Mar 1969. 65 p.

Descriptors: *Stochastic processes, *Optimization, Computers, Computer programming.
Identifiers: Probabilistic programming, Vector optimization, Optimum value, Programs with recourse, Chance constrained programs.

This work provides an organization and summary of the major results in the field of stochastic (or probabilistic) programming. Mathematical derivations and proofs are largely omitted both for lack of space and because they are unnecessary. The purpose of this work is to give an overview of the field and references for those who wish to investigate further. Initially, a very general problem of programming under uncertainty is defined. Next, various ways of interpreting this problem and the resulting methods of handling its uncertainty are discussed. The bulk of the paper is devoted to those interpretations which appear to have received the most attention in the literature: vector optimization, the distribution of the optimum value, programs with recourse, and chance constrained programs. Finally, a few special topics are considered.
W69-09772

6B. Evaluation Process

AN ASSESSMENT OF THE NATION'S WATER RESOURCES,
Water Resources Council, Washington, D.C.
Bruce Blanchard.
'The Nation's Water Resources' is available from Superintendent of Documents, Government Printing Office, Washington, DC. 20242. J Water Pollut Contr Federation, Vol 41, No 8, Part 1, p 1407-1420, Aug 1969. 14 p, 11 fig, 4 tab.

Descriptors: *Reviews, *Water resources, *United States, Water Resources Planning Act, Water supply, Water levels, Streamflow, Water utilization, Waste water treatment.
Identifiers: First National Water Resources Assessment.

Some of the technical information contained in the Water Resources Council's First National Assessment is reviewed. Comments cover background information on the Water Resources Planning Act, the long-run plans for the National Assessment, and illustrations of variations in the water situation in the Ohio, Missouri, Rio Grande, and Columbia-North Pacific regions. The National Assessment was published in November 1968. (Knapp-USGS)
W69-09452

PUMPED STORAGE--THE HANDMAIDEN OF NUCLEAR POWER,
Northeast Utilities Service Co., Hartford, Conn.
Sherman R. Knapp.
Inst Elec Electron Eng Spectrum, Vol 6, No 4, p 46-52, Apr 1969. 7 p, 3 fig, 2 tab, 1 ref.

Descriptors: *Pumped storage, *Nuclear powerplants, *Hydroelectric power, Costs, Economics, *Peaking capacities, Benefits, Recreation, Peak loads, Cost comparisons, Electric power production, Electric power, Electric power costs, Electric power demand, Powerplants.
Identifiers: *Nuclear power, Fossil fuels, *Northfield Mountain Proj (Mass), Base loads, Spinning reserve.

Construction of pumped-storage hydro plants, favored by area topography, will offset the relatively high fixed costs of nuclear plants by maximizing the capacity-use factor of nuclear facilities and minimizing the total cost per unit of energy output. This combination provides efficient base load, economical peaking capacity, effective spinning reserve, and many recreational and other social benefits. Power companies in the New England states, where fossil-fuel cost is high, have determined that low-variable-cost nuclear generation is desirable for this region. The 1000-mw pumped-storage Northfield Mountain Project in Massachusetts, used for peaking and reserve standby in the New England power systems, is reviewed, giving specific references to economies and social benefits derived from the project. Cost comparisons of base-load nuclear units in combination with gas turbine, steam peaking, and pumped hydro plants are given for the 1973 and 1977 predicted large-area loads in the New England states. (USBR)
W69-09551

ORGANIZATIONAL ALTERNATIVES FOR RECREATIONAL RESOURCE MANAGEMENT: AN ANALYSIS OF STATE AGENCIES,
Michael F. Brewer, and Betty Bordner.
Natural Resources Journal, Vol 6, No 4, p 560-579, Oct 1966. 20 p, 13 ref.

Descriptors: *Administrative agencies, Inter-agency cooperation, Political aspects, Planning, Economic efficiency.
Identifiers: *Recreational resource management, State agencies, Scope of jurisdiction, Objectives, Interest groups.

The purpose of this study is to identify the specific activities entailed in recreational resource management; to determine the particular organizational arrangements for these activities; and to evaluate typical state organizations employed for these purposes. Consideration was also given to those public recreational resources for which responsibility is divided among a number of organizations. First, the structures of recreational agencies sharing responsibility in particular states were identified, classified, and evaluated in terms of the way they perceive the objectives of recreational resource management and in terms of their scope of jurisdiction. Second, the influence of this organizational structure upon a constituent agency was assessed using criteria generally consistent with the welfare-economics notion of efficiency. Results indicate that the greatest advantage of single-resource agencies is their ease of access to interest groups. However, their limitations with respect to a broad planning scope, a wide range of technical competence, and common analytical practices severely limit their advantage of access, especially in planning. Unified agencies are strong in planning scope, technical competence, and uniform analytical procedures. They also have potential for establishing communication to interest groups. (Gossen-Chicago)
W69-09561

POLLUTION AND ENVIRONMENTAL QUALITY,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W69-09563

ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS,
For primary bibliographic entry see Field 05G.
W69-09565

REPORT ON OHIO RIVER RECREATION FACILITY, CITY OF PORTSMOUTH AND SCIOTO COUNTY, OHIO.
Stanley Engineering, Cleveland, Ohio.

Stanley Engineering Company, Muscatine, Iowa, 1963. 38 p, 16 fig, 8 tab, 18 ref, 2 append. Area Redevelopment Admin., Washington, DC.

Descriptors: *Marinas, *Planning, *Recreation facilities, *Economic impact, Boating, Access routes, Tourism, Water utilization, Benefit-cost analysis.
Identifiers: *Portsmouth (Ohio), *Scioto County (Ohio).

Scioto County and Portsmouth, Ohio have experienced a depressed economy as a result of changes in industry. These areas desire to improve their economic conditions through planning. One possibility is the creation of a marina and related recreation facilities near Portsmouth, Scioto Coun-

ty, Ohio. Analysis of the population and boat use in the geographic area that such a marina would draw from shows adequate demand to justify installation on the Ohio River of a marina-recreation facility having berths and year-around storage for approximately 100 boats. Also included in the project would be facilities for servicing and launching boats; an Operations Building; Sales, Service, and Administration Building; Snack Bar and Restaurant; and Parking Area. Five possible site locations are analyzed in relation to topography, river characteristics, accessibility, and relation to cultural features. The feasibility of the project is analyzed by developing the annual benefit and costs of the proposed project. The proposed project is found to be economically feasible and would have demonstratable economic impact on the area. It is recommended that the project be implemented by public agency construction of the project with lease of the facilities to a private business venture for operation and maintenance. (Marriott-Chicago)
W69-09568

HYDROLOGIC RESEARCH FOR WATERSHED ENGINEERING,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 04D.
W69-09669

GROUNDWATER APPRAISAL OF THE LITTLE WABASH BASIN ABOVE THE GAGE BELOW CLAY CITY AND THE LOUISVILLE RESERVOIR SITE, ILLINOIS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09693

GROUNDWATER APPRASIAL OF THE SKILLET FORK BASIN ABOVE WAYNE CITY AND HELM RESERVOIR SITE, ILLINOIS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09694

GROUNDWATER APPRAISAL OF THE BIG WALNUT CREEK BASIN ABOVE LITTLE WALNUT CREEK AND BIG WALNUT CREEK RESERVOIR SITE, INDIANA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09695

GROUNDWATER APPRAISAL OF THE BIG BLUE RIVER BASIN AND BIG BLUE RESERVOIR SITE, INDIANA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09696

GROUNDWATER APPRAISAL OF THE FLATROCK RIVER BASIN AND DOWNEYVILLE RESERVOIR SITE, INDIANA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W69-09697

THE MILWAUKEE RIVER,
Milwaukee River Technical Study Committee, Wis.
Harry C. Brockel.
Milwaukee River Tech Study Comm Rep, 1968. 163 p, 5 fig, 5 map, 43 photo, 11 tab, 62 ref.

Descriptors: *Rivers, *Urbanization, *Multiple-purpose projects, *Recreation, *Wisconsin, Navigation, Aesthetics, Parks, Recreation facilities, Landscaping, Land use, Scenery, Water quality, Water pollution, Water pollution control, Planning.
Identifiers: Milwaukee River, Milwaukee.

The problems of the Milwaukee River, Wisconsin were inventoried and recommendations are listed for improvement of the river for aesthetic and recreational uses for the city of Milwaukee. The present quality of the river water and banks are surveyed and compared with past conditions as well as present conditions of rivers in other cities. It is concluded that the Milwaukee River can be a great asset to Milwaukee with a reasonable expenditure of time, money, and effort. The present blighted condition of the river banks in the downtown area should actually help in land acquisition for restoration, because it has depressed land prices. San Antonio, Texas is used as an example of what a city can do in restoring a river for public emjoyment. (Knapp-USGS)
W69-09703

THE IDENTIFICATION AND CRITICAL ANALYSIS OF SELECTED LITERATURE DEALING WITH THE RECREATIONAL ASPECTS OF WATER RESOURCES USE, PLANNING, AND DEVELOPMENT,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 10.
W69-09719

HUMBOLDT RIVER STUDIES,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 04B.
W69-09724

A PLAN FOR A COMPREHENSIVE WATER RESOURCES RESEARCH INFORMATION EXCHANGE SYSTEM,
Leeds, Hill and Jewett, Inc., San Francisco, Calif.
For primary bibliographic entry see Field 10.
W69-09737

TOWARD A NATIONAL WATER PLAN,
Lewis Gordy Smith.
Pap, Irrig Age, 1969. 23 p, 18 fig.

Descriptors: *Planning, Water reuse, Import, Natural resources, *Water resources development, *Water collection system, Water, Pumping plants, Water conveyance, Population growth, Preliminary investigations, Canals, Water requirements, Cloud seeding, Demineralization, Reservoirs, *Water distribution (Applied), Tunnels, Dams, Siphons, Inter-basin transfers.
Identifiers: *Water plans, Canada, *Western United States, International cooperation.

Water is the one limiting basic resource having the most influence on the comforts of an expanding population of this nation. The greatest challenge to the Western United States is a need to overcome the persistent lack of water. A concept of a water collection and distribution system using northern Canadian water to provide water for the Prairie Provinces of Canada and the 17 Western States of the U S is discussed. The elements of a comprehensive water augmentation system for the Great Lakes region are outlined. Because of the recognized importance of this single unique commodity, water augmentation merits a new, higher priority among our national policies for the economic justification of large water augmentation projects and t hose affecting whole segments of the nation, and, thereby, the entire nation. Implementing such a water plan requires much time; planning must start many years before the actual need exists. (USBR)
W69-09766

PLAN AND PROGRAM FOR THE BRANDYWINE,
Pennsyl vania Univ., Philadelphia. Inst. for Environmental Studies.
Robert J. Coughlin, John C. Keene, Benjamin H. Stevens, and Ann Louise Strong.
Pennsylvania Univ, Inst for Environmental Studies, Oct 1968. 228 p.

Descriptors: *Urbanization, *Drainage systems, *Land use, Storm runoff, *Water resources development, Land tenure, Real propert, Legislation..
Identifiers: Brandywine, Chester Co (Penna), *Conservation easements.

The Plan is a proposal for the wise use of the water and land resources of the Upper East Branch of Brandywine Creek, Chester Co., Pa. The Plan was developed for the Chester Co. Water Resources Authority by the Institute for Environmental Studies, University of Penna; Regional Science Research Inst.; United States Geological Survey; and their consultants. The aim of the Plan is to prevent deterioration of the water resources and thus to retain the amenities of related land when urbanization occurs in the Brandywine watershed. The Plan recommends 3 types of action: public purchase of conservation easements or other less than fee interests on floodplains, stream and swale buffers, steep slopes and forests; development and adoption of detailed water supply and sewage disposal plans in advance of urbanization; and enactment of strong local regulations for erosion and storm runoff control.
W69-09768

STRATEGIC CONSIDERATIONS IN ATTAINING WATER RESOURCES PLANNING GOALS,
Wisconsin Univ., Madison.
I. K. Fox.
Journal Water Pollution Control Federation, July 1969, Vol 41, No 7, p 1368-1376. 9 p, 5 ref.

Descriptors: *Administrative agencies, Water resources development.
Identifiers: *Conservation agencies, Decision making processes, Public planning, Strategies.

This paper suggests how planning fits into decision-making in a democratic system, how it contributes to the effectiveness of the system, and what strategies planning entities should use to maximize effectiveness. Since people have differing value preferences, not all people will favor the same plans. The function of public planning is to identify and evaluate alternative courses of action so as to aid individuals and organizations in deciding what course of action they favor. Since the objective is to secure a complete airing of differing objectives and potential programs, the various interests should have the opportunity to marshall and present programs which they support. These concepts suggest different strategies for different agencies and organizations. The Executive Office of the President, as an agency that seeks to represent the nation as a whole, should foster the presentation of competing plans so that it can make a more intelligent choice among the alternatives. The federal water development agencies should present alternative plans for public consideration, if the danger of stalemate among competing interests is to be avoided. The state agencies should pursue a planning role independent of the federal agencies until alternatives have been assessed and the state interest determined. The conservation agencies should be staffed to prepare and support plans that best serve their own interests. And the private interest groups should not only criticize and support the plans of others, but should also be staffed to prepare and support plans that best serve their interests. This framework would enrich the supply of information about alternative plans and thus improve decision-making processes.
W69-09771

CONSTITUTIONAL ISSUES IN GAS AND OIL: AN ANALOGY,
For primary bibliographic entry see Field 06E.
W69-09793

CONCLUSIONS AND RECOMMENDATIONS,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W69-09800

IOWA NATURAL RESOURCES COUNCIL.

Iowa Code Ann secs 455A.1 to 455A.39 (Supp 1969).

Descriptors: *Iowa, *Flood control, *Water resources, *Water control, Flood plains, Diversion, Flood plain zoning, Legislation, Flood protection, Storage, Encroachment, Permits, Withdrawal, Water resources development, Water management (Applied), Floodways, Surface waters, Groundwater, Beneficial use, Wastes, Watercourses (Legal), Basins, Impounded waters, Average flow, Administrative agencies, Regulation.

Recognizing the importance of flood control and the orderly development, wide use, protection and conservation of the state's water resources, the Iowa Natural Resources Council is created and has the following functions and duties: (1) to establish and enforce a comprensive state-wide program for the control, utilization and protection of the state's surface and groundwater resources; (2) to coordinate state planning with local and national planning; (3) to enter into negotiations and agreements with the federal government relative to federally authorized or constructed projects; (4) to construct flood works; (5) to coordinate the design, construction, and operation of all flood control works; (6) to control the issuance of permits to divert, store, or withdraw waters and to investigate the potential effects of such uses; and (7) to establish and enforce regulations for the development and use of the flood plains of the state's rivers and streams, including encroachment limits, protection methods, and minimum protection levels. For purposes of this act flood plains, floodway, surface water, groundwater, diffused waters, depleting use, beneficial use, regulated use, nonregulated use, waste, watercourse, basin, established average minimum flow, and impounded water are defined. (Marsee-Fla)
W69-09828

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

CONVENTION AND LIMITATION IN BENEFIT-COST ANALYSIS,
Richard J. Hammond.
Natural Resources Journal, Vol 6, No 2, p 195-222, Apr 1966. 28 p, 28 ref.

Descriptors: *Cost-benefit analysis, Decision-making, History, Optimization, Return (Monetary), Cost-benefit ratio, Legislation.
Identifiers: *Green Book, Informed common sense, Opportunity costs, Benefit minus cost.

The article addresses itself to two questions: (1) How, and how far, is it possible to secure uniformity of practice between different agencies using benefit-cost analysis. (2) At what point does a further increment of speculation promise less than a commensurate increase in the accuracy of the forecast. A history is given of the rise of benefit-cost analysis to its exalted position of authority in resource questions. Development of the Green Book is described. The most influential and persistent error in the Green Book stems from the fallacy of maximizing net returns. By failing to consider the differences in opportunity costs, the prescribed method of analysis often fails to seek the maximum return on capital. Inclusion of opportunity costs reinstates the use of benefit-cost ratios over benefit minus cost. The article emphasizes that a prescriptive rule of behavior is not applicable to every case without qualification. Congress is not absolved of its final responsibility of decision by calculations which seem, falsely, to have dispensed with uncertainty. The range of error in benefit-cost analysis prohibits calling it 'accurate'; it is a measure of putative performance and no more. (Gossen-Chicago)
W69-09560

THE FINANCING OF SMALL MUNICIPAL WATER SYSTEMS IN GEORGIA,
Georgia Univ., Athens. Dept. of Agricultural Economics.
Howard Waldas.
MS Thesis, Univ of Georgia, Athens, Ga, Aug 1968. 218 p, 7 fig, 19 tab, 31 ref, 1 append. OWRR Proj B-011-GA.

Descriptors: *Municipal water, *Water rates, *Water costs, *Interest rate, *Financing, *Georgia, Cost repayment (Ability), Water values, Elasticity of demand, Government finance, Public utilities.

Objectives of the research were (1) to determine what methods of financing water systems are available to smaller municipalities, (2) to select and analyze the various factors that affect the ability of municipalities to obtain financing for developing their water systems, and (3) to indicate the future of financing of municipal water systems by the projection of current trends. Data on municipal interest rates and repayment abilities together with other pertinent information were obtained by personal survey of a randomly selected ten percent of Georgia's smaller municipalities. Officials of 49 municipalities with populations under 10,000 were interviewed. Three major sources of funds for municipal water systems are analyzed: (1) Water revenues from special assessments, user charges, fire protection fees, connection fees, and ad valorem taxes, (2) municipal securities composed of general obligation, special assessment, and revenue bonds, and (3) Federal loans and grants from the Farmer's Home Administration, the Economic Development Administration, and the Soil Conservation Service. Factors that affect the interest rate and the repayment ability of a municipality have been isolated and their significance measured. Models were designed from measured variables to permit a small Georgia city to compute the interest rate and repayment ability that could be expected from their financial status. Use of the models by smaller, unrated municipalities will enable them to have their financial position considered objectively by potential investors. Projections indicate that 56.7 percent of water systems financed by the cities sampled will be through Federal grants and loans. The trend toward Federal funds for financing small municipal water systems will continue as long as Federal programs offer lower interest rates. (Conway-Ga Inst of Tech)
W69-09730

ECONOMIC INCENTIVES AND WATER QUALITY MANAGEMENT PROGRAMS,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05G.
W69-09769

FEDERAL FLOOD CONTROL COORDINATION.
For primary bibliographic entry see Field 04A.
W69-09829

6D. Water Demand

THE IDENTIFICATION AND CRITICAL ANALYSIS OF SELECTED LITERATURE DEALING WITH THE RECREATIONAL ASPECTS OF WATER RESOURCES USE, PLANNING, AND DEVELOPMENT,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 10.
W69-09719

THE DEMAND AND PRICE STRUCTURES FOR WATER IN A HUMID AREA,
Georgia Univ., Athens. Dept. of Agricultural Economics.
Ronald M. North.
Department of Agricultural Economics, College of Agriculture, University of Georgia, Athens, Georgia, July 1969. 6 p, 10 ref. OWRR Project B-011-GA.

Descriptors: *Georgia, *Water costs, *Water rates, *Elasticity of demand, *Elasticity of supply, *Humid areas, Economics, Marginal productivity, Social values, Monetary returns, Southeast U.S., Municipal water systems, Water users.

The purpose of this study was to determine the price and income elasticities for water consumption in the humid Southeastern United States. Householders in 14 municipal water systems were interviewed for socio-economic characteristics and water consumption was correlated with these characteristics. In the Southeast the physical factors such as lawn area did not significantly affect household consumption of water. However, definite differences in consumption of water were found due to variations in prices of water and incomes or income surrogates such as value of the residence. Price elasticities were generally about -0.68 and income elasticities were generally about+0.80. Industrial consumption in poultry processing plants, textile finishing and pulp manufacturing varied considerably among plants in each industry according to gross use and use per unit of product. However, these variations appeared more closely related to such things as age of plant and management practices and not to the price of water nor to the value of marginal product produced by that water. (Conway-Ga Inst of Tech)
W69-09727

FACTORS INFLUENCING THE DEMAND FOR WATER IN POULTRY PROCESSING PLANTS,
Georgia Univ., Athens. Dept. of Agricultural Economics.
Donald L. Brewer.
MS Thesis, Univ of Georgia, Athens, Ga, June 1969. 94 p, 3 fig, 1 tab, 54 ref, 6 append. OWRR Proj B-0011-GA.

Descriptors: *Water demand, *Water costs, *Water values, *Marginal prices, *Southeast U.S., Wages, Georgia, Water users, Water reuse, Elasticity of demand, Industrial water.
Identifiers: Poultry industry, Poultry processing.

Objectives of the research were to determine the demand and factors influencing the quantity of water used in poultry processing plants and to determine the physical differences in the processing plants and how the differences affected water use. Data were collected by personal interview from randomly selected poultry processors located in a six-state area in Southeast U.S. From these data variables were selected to determine the influence on water usage by the processors. The production function was used also to derive the demand for water. Five independent variables were found that explained best the total amount of water withdrawn. These are the number of employees, the hourly wage rate, the marginal physical productivity of water, the marginal price of water, and the percent of water recycled. Water used per bird is explained by an equation with two independent variables, Federal inspection and the hourly wage rate. Three production functions were used in analyzing the data. These were the Cobb-Douglas equation, the quadratic equation and the square root equation. It was found that 88 percent of the variation was explained in the quadratic equation and in the square root equation. Various combinations of independent variables were used to explain the variations in total volume of water withdrawn and in the volume of water used per bird in selected poultry processing plants. The presence of Federal inspection and the hourly wage rate were important factors correlated with variations in water used per bird. Contrary to the original hypothesis, the price of water was of little value in explaining variations in water used in the processing plants. (Conway-Ga Inst of Tech)
W69-09729

6E. Water Law and Institutions

SANITARY AND DRAINAGE COMMISSIONS.
For primary bibliographic entry see Field 04A.
W69-09458

AID TO MUNICIPALITIES FOR WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09523

MARINE TOILETS AND DISPOSAL OF SEWAGE FROM BOATS.
For primary bibliographic entry see Field 05G.
W69-09524

CONSERVATION: MINERALS IN SUBMERGED LANDS (LEASING OF STATE SUBMERGED LAND FOR MINING).

Del Code Ann tit 7, sec 6401-6440 (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Leases, *Mining, Beds under water, Administrative decisions, Adjudication procedure, Legislation, Exploration, Exploitation, Oil, Natural gas, Sulfur, Permits, Surveys, Bids, Governors, Easements, Drilling, Negotiations, Royalties, Feasibility, Public rights, Regulation, Water pollution, State jurisdiction, Federal government, Insurance, Landfills, Rent, Shores, Seismic studies.
Identifiers: Delaware Water and Air Resources Commission.

The governor and the Water and Air Resources Commission are given the jurisdiction to lease state submerged lands for the purpose of mining oil, natural gas, sulphur, and other minerals. Definitions of terms used in the legislation are given. The Commission may grant permits for geological surveys of the submerged lands. The permittee is to follow regulations set out governing the permits. The Commission may examine the permittee's records but must keep them confidential. Before the Commission can lease lands it must hold a public hearing to determine the feasibility of the lease. The Commission must consider certain factors in deciding the feasibility of leasing. The lease gives exclusive drilling and mineral removal rights over a certain area. The lessee is to pay royalties and rents along with a performance bond. The Commission may permit different types of drilling and lease extensions. The lessee must protect against water pollution and upon termination of the lease may have to restore the property to its original condition. Certain schedules for drilling and production must be met. The Commission must consent to an assignment of the lease. The lessee may surrender the lease, or the state may cancel it upon certain circumstances. The Commission must follow certain bidding procedures. Successful bidders must comply with certain requirements before the execution of the lease. The Department of Defense must give prior approval to a lease. (Gadd-Fla)
W69-09537

CONSERVATION: MINERALS IN SUBMERGED LANDS (LEASING OF STATE SUBMERGED LAND FOR MINING).

Del Code Ann tit 7, sec 6401-6406 (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Permits, *Beds under water, Leases, Exploration, Exploitation, Mining, Oil, Natural gas, Sulfur, Surveys, Administrative decisions, Shores, Adjudication procedure, Legislation, Regulation, Governors, Drilling, Seismic studies, State jurisdiction, Easements, Land, Subsurface investigations.
Identifiers: Delaware Water and Air Resources Commission.

The Governor and the Water and Air Resources Commission shall have jurisdiction to lease all submerged tide lands of this state. The leases are to be awarded for mineral exploration and exploitation. The Commission may not permit any interference, other than temporary interference, with the surface of the Atlantic shore. The Commission may, however, grant easements to portions of the surface of the Atlantic shore owned by the State to permit extraction of minerals. Lands administered by the Board of Game and Fish Commissioners cannot be leased by the Commission. Any person may apply to the Commission for a permit for making geological surveys on the tide and submerged lands of the state. The permit shall contain rules and regulations to protect natural resources. The permit will also limit the survey to specified lands. The permit is not exclusive and gives no preferential rights to any oil, gas, sulphur, or other mineral lease. A permit is not to exceed two years. The Commission may deny a permit on lands which would not be leased even if a lease were applied for. The Commission may require the permittee to make his survey records available to the Commission. Also the Commission may require as a condition to issuance of any lease that the lessee make available to the Commission all of his exploration records. The records from both the permittee and lessee are not to be disclosed. (Gadd-Fla)
W69-09541

CONSERVATION: MINERALS IN SUBMERGED LANDS (LEASING OF STATE SUBMERGED LAND FOR MINING).

Del Code Ann tit 7, sec 6407-6415 (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Leases, *Beds under water, Bids, Feasibility, Public rights, Regulation, Drilling, Royalties, Rent, Administrative decisions, Legislation, Oil, Natural gas, Sulfur, Insurance, State jurisdiction, Water pollution, Shores, Land, Land tenure.
Identifiers: Delaware Water and Air Resources Commission.

The Water and Air Resources Commission shall hold a public hearing before lands are offered for leasing or upon an application for a lease. Notice of the hearing and the specific submerged lands under consideration is to be given to various state agencies, to the public, and to prospective applicants and bidders. The Commission may appoint an officer or employee to conduct the hearing. Any representative of the various state agencies served with notice of the hearing may question witnesses at the hearing. The Commission shall consider the feasibility of the lease considering the following factors: welfare of persons near the area of the lease; interference with recreational or residential areas; the esthetic and scenic value of the coast line; pollution; marine life; navigation; and drainage of minerals from state lands. A lease shall not be given for an area larger than six square miles. A lease shall grant the exclusive right to drill for and produce oil, gas, and other minerals. The lease extends for a primary term of ten years and for so long after the primary term as the lessee is producing or diligently attempting to produce. The Commission is to give a lease which requires at least 12 1/2% of gross production as a royalty. Also the Commission must specify a rent of at least $.25 an acre annually in the lease. The Commission may require insurance and performance bonds from the lessee as a condition to the lease. (Gadd-Fla)
W69-09547

CONSERVATION: MINERALS IN SUBMERGED LANDS (LEASING OF STATE SUBMERGED LAND FOR MINING).

Del Code Ann tit 7, sec 6415-6440 (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Leases, *Beds under water, Bids, Well regulations, Administrative decisions, Drilling, Landfills, Offshore platforms, Negotiations, Water pollution, Permits, Oil, Natural gas, Sulfur, Governors, Regulation, Exploration, Federal Government, State jurisdiction, Permits, Land use, Land tenure.
Identifiers: Department of Defense.

A lessee may use slant drilling or adjacent drilling unless prohibited by the Water and Air Resources Commission. The Commission may require the restoration of the portion of the premises visible at low tide upon termination of a lease or permit. The lessee must exercise a high degree of care to prevent pollution from arising from its operations. The Commission may grant an extension of a lease when the lessee must acquire a federal or state permit for construction of a drilling platform. The lessee must commence drilling within five years from the date of the lease and commence production within three years of discovery. A lessee may not assign his lease without Commission approval. The state reserves the right to permit reasonable nonconflicting uses of the land covered in the lease. The lessee may surrender the lease subject to the duty to pay all rent and royalties and to place all production facilities in condition for abandonment. Upon default by the lessee, the state may cancel the lease. The Commission must give notice by publication of all offers to lease. The successful bidder must pay the cash bonus and first year's rent in advance. The Governor and Commission shall execute the lease. The Commission is empowered to make rules and regulations to regulate surveys and production operations. The Department of Defense must approve all leases and permits prior to their approval by the state. (Gadd-Fla)
W69-09548

INTERNAL ORGANIZATION AND POWERS OF TAX DITCH.

Del Code Ann tit 7, secs 4151-4168 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Taxes, *Drainage programs, *Administrative agencies, Assessments, Tax rate, Ditches, Legislation, Legal aspects, Economics, Costs, Drainage, Drainage systems, Administration, Drainage practices, Capital, Cost allocation, Resource allocation, Eminent domain, Proprietary power.
Identifiers: Tax base.

Managers for the tax ditch are elected by the taxables within the ditch area at an organizational meeting called by the state drainage engineer soon after the ditch order becomes final. While ditch managers may meet as often as is necessary to conduct business, annual meetings are held in which all taxables may take part. The powers of a tax ditch include levying taxes, making and executing necessary instruments, borrowing money, exercising eminent domain, and maintenance of the tax ditch under certain circumstances. Ditch managers in performing their duties must determine from the taxables the desired programs of operation, determine the amount of taxes necessary for such programs, secure from the majority of taxables voting specific authority to borrow money for the tax ditch, and perform a number of other tasks necessary for the tax ditch to operate smoothly. The secretary-treasurer of the tax ditch who must be bonded keeps minutes of all meetings of the tax ditch managers and prepares an annual financial statement. The tax ditch may borrow up to 90% of the total assessment base established by the ditch order. (Johnson-Fla)
W69-09549

CONSERVATION.

Del Code Ann tit 7, secs 2710-2717 (Supp 1966).

Descriptors: *Delaware, *Shellfish, *Fish conservation, *Regulation, Legislation, Oysters, Dredging, Boats, Ships, Fishing, Fishing gear, Commercial fishing, Commercial shellfish, Adjudication procedure, State jurisdiction, Conservation, Fish management, Legal aspects, Jurisdiction.
Identifiers: Penalties (Civil), Penalties (Criminal), Liens.

The captain of any watch boat is authorized to seize any vessel used in violation of shellfish laws and arrest its crew when he has reliable information of such illegal use or upon warrant issued by a justice of the peace. The justice of the peace shall fix a hearing date, which shall be not more than 5 days from the arrest. Upon conviction a fine shall be im-

posed upon the defendants which shall constitute a lien on the seized vessel. Upon failure to pay the fine within 15 days the vessel shall be sold at public auction. Defendants may appeal to the superior court upon posting of bond in double the amount of the fine. When a vessel is sailing over oyster grounds with dredges overboard and attended, it shall be conclusive evidence that such vessel is dredging for oysters. Any justice of the peace of this state shall have jurisdiction over every violation of the provisions of this chapter. Violators may be punished by fine not less than $100 nor more than $1000 and upon failure to pay such fine imprisoned not less than one nor more than six months. (Kahle-Fla)
W69-09553

CONSERVATION--TAKING OF LOBSTERS.

Del Code Ann tit 7, secs 2501-2504 (Supp 1966).

Descriptors: *Delaware, *Lobsters, *Fish conservation, *Regulation, Atlantic Ocean, Legislation, Fish management, Wildlife conservation, State jurisdiction, Fishing gear, Trapping, Seasonal, Spawning, Shellfish, Commercial shellfish, Commercial fishing.
Identifiers: *State waters, Penalties (Civil), Penalties (Criminal), Lobster pots.

Lobsters may not be taken in state waters between September 1, and April 30, or between 2:00 PM Saturday and 12:00 midnight Sunday. Lobsters may not be taken except by lobster pot, trap or set. No more than 50 such pots or traps may be used at one time. Pots or traps may not be connected together in any manner. No spawning lobster, or lobster measuring less than 3 1/8 inches from the rear of the eye socket to the rear of the body shell may be taken in state waters, including the Atlantic Ocean within 3 miles of the coastline. Lobsters less than 3 1/8 inches may not be possessed or sold wi thin the state no matter where taken. Lobsters may not be taken from state waters by non-residents or aliens. Taking, possessing, or selling undersized lobsters is punishable by $5 fine for each such lobster or imprisonment of not more than 15 days. Other violations of these provisions are punishable by fines not less than $20 or, upon failure to pay the fine, imprisonment of not more than 30 days. Aliens and non-residents may be fined not less than $50 for violations. (Kahle-Fla)
W69-09556

ORGANIZATIONAL ALTERNATIVES FOR RECREATIONAL RESOURCE MANAGEMENT: AN ANALYSIS OF STATE AGENCIES,
For primary bibliographic entry see Field 06B.
W69-09561

WATER LAW--THE RISE AND FALL OF NEW MEXICO'S TEMPLETON DOCTRINE,
Timothy W. Glidden.
Natural Resources Journal, Vol 6, No 2, p 325-333, Apr 1966. 9 p.

Descriptors: *Surface-groundwater relationships, *Judicial decisions, New Mexico, Prescriptive rights, Water transfer, Adjudication procedure, Relative rights, Water law, Legal aspects.
Identifiers: Impairment of existing rights.

The interrelationship of surface and groundwaters has long been an axiomatic concept in hydrology; the problem is incorporating the concept into the legal structure. Public waters in New Mexico are regulated under two outdated classifications--groundwaters and surface waters. The surface-right holder of a given amount of public water from a given source has no means of replenishing his surface supply when it is depleted. The Templeton decision, which allowed Templeton to follow his surface right to its source by changing his point of diversion from a surface appropriation to a ground appropriation, appeared to represent a breakthrough in New Mexico law. Subsequent cases revealed that Templeton was not a universal solution, primarily because of problems involving impairment of existing rights. The article urges that impairment problems created by transfers be faced squarely rather than avoided by eliminating the possibility of transfers. The legislature should recognize that transfers are necessary and possible under certain circumstances and should incorporate that recognition into law. The results would ease the limitations on surface-right holders and contribute materially to revising the obsolete classification of public waters. (Gossen-Chicago)
W69-09562

CONSOLIDATION OF WATER CONTROL COMMISSION AND WATER RESOURCES BOARD.

NH Rev Stat Ann secs 481:22-481:24 (1968).

Descriptors: *New Hampshire, *Administrative agencies, *Water policy, *Administration, Legislation, Legal aspects, Water law, Political aspects, State governments, Governments, Water policy, Water control.

The state Water Control Commission is merged with the Water Resources Board which must discharge all the duties and obligations which were assigned to the Commission. The Board continues to be a corporation under the laws of New Hampshire and is subject to the same obligations and duties as prior to the merger and retains the same rights, powers, privileges and immunities as before. (Johnson-Fla)
W69-09567

POLLUTION: REGULATION AND THE ANTITRUST LAWS,
For primary bibliographic entry see Field 05G.
W69-09577

OUR NATION AND THE SEA (A PLAN FOR NATIONAL ACTION).
Committee on Marine Science, Engineering and Resources, Washington, D.C.

Report of the Comm on Marine Science, Engineering and Resources, p 49-81, Jan 1969. 33 p, 3 tab, 3 fig.

Descriptors: *Coasts, *Federal government, *Oceans, *Management, Beaches, Coastal engineering, Coastal structures, Harbors, Law of the sea, International law, Shores, Fishing, Oil, Industries, Exploration, State governments, Administrative agencies, Pollution, Pollution abatement, Pollution control, Costs, Manpower, Recreation, Wastes.
Identifiers: Coastal management system, Waste management.

To insure effective use of coastal areas, a sound management system must be devised that will give developmental alternatives, provide for proper planning and recognize the importance of this productive region. Coastal zone uses are varied and any management system must cope with all uses and rights. Uses of the coastal area are intensifying and moving seaward. Shoreline and offshore industrial uses demand that a management system deal with problems accompanying this movement. The Commission on Marine Science, Engineering and Resources recommends federal legislation to establish a coastal zone policy putting the management in federally funded state authorities. The authorities would be independent and would have sufficient power to accomplish their objectives. To protect national interests, actions would be subject to federal review. To establish a basis for decision making, continuing surveys and studies of the coastal zones must be made and data compiled. Effective use of these zones demands coastal pollution be abated and programs for achieving and maintaining water quality invoked. Such pollution programs must be in the context of and integrated with waste management in the entire environment. (Helwig-Fla)
W69-09578

THE COMMON LAW BACKGROUND OF THE RIPARIAN DOCTRINE,
T. E. Lauer.
Mo L Rev, Vol 28, No 1, p 60-107, Winter 1963. 48 p, 218 ref.

Descriptors: *Water law, Reasonable use, *Natural flow doctrine, *Riparian rights, Publications, Legal aspects, Water utilization, Diversion, Prior appropriation, Water rights, Riparian land, Watercourses (Legal), Public rights, Civil law.

A thorough presentation of the common law development of English water use law is made. The origin of the American doctrine of water use, whereby each owner of land upon the banks of a watercourse has a right to make a reasonable use of the water, is customarily placed shortly after the year 1825. This riparian doctrine has been ascribed to Joseph Story and James Kent. In the years following 1825, the English courts were to abandon prior use and to embrace instead the natural flow doctrine. Then in 1851, the court of Exchequer adopted the American riparian doctrine with its basis of reasonable use. In 1825, the common law contained the seeds of the reasonable use test; the development across the centuries had been in the direction of a flexible standard enabling the greatest beneficial use of watercourses. Story and Kent, conversant with this common law background, drew heavily upon the Code Napoleon and Roman law in constructing the riparian doctrine. But, the continental legal system can be assigned only a paternal role. The gestation of the doctrine occurred within the matrix of the common law, over centuries of judicial experience and growth. (Childs-Fla)
W69-09579

A UNIFIED CABINET-LEVEL DEPARTMENT OF WATER DEVELOPMENT AND OPERATION HAVING FULLY COORDINATED FUNCTIONAL SERVICES TO MEET MODERN NEED. NATIONAL AND INTERNATIONAL,
Shu-t'ien Li.
Int'l Conference on Water for Peace, Washington: U.S. Government Printing Office, Vol 5, p 365-371, 1967. 7 p. For 8 volume Proceedings see Vol 2, No 9, Field 6B, W69-03305.

Descriptors: *Water resources development, *Regulation, *Administration, Water allocation (Policy), Surveys, Research and development, Federal government, Political aspects, Social aspects, Interstate rivers, Watersheds (Basins), Publications, Institutions, Administrative agencies, Data collections, Conservation, Water supply, Waste-water (Pollution), Reclamation, Flood control, Water pollution control, Hydrodynamics.

Government agencies for water development and operation can be most efficiently organized on the multi-phase principle of streamlined unification, coordinated functional services, optimum centralization, and dynamic cooperation among all concerned. The basic framework of such an organization is presented. The components of the proposed organization are: (1) national hydro-data service; (2) national hydro-conservation service; (3) national water supply service; (4) national waste-water sanitation service; (5) national reclamation and flood control service; (6) national hydroelectric power service; (7) waterways, harbors, and maritime administration; (8) water pollution control administration; (9) interstate water administration; (10) international cooperation administration; (11) water development financing administration; (12) water research and development administration; and (13) wet space administration. It is submitted that only a unified cabinet-level department of water development and operation may generate fully coordinated functional services to meet modern water needs of mankind. (Childs-Fla)
W69-09580

ROLE OF STATE GOVERNMENTS IN U. S. WATER MANAGEMENT,
Dwight F. Metzler.
Int'l Conference on Water for Peace, Washington: US Government Printing Office, Vol 5, p 402-407, 1967. 6 p.

Descriptors: *State government, *Water resources development, *Water policy, *Water allocation (Policy), State jurisdiction, Planning, Political aspects, Management, Social aspects, Regulation, Coordination, Water problems, Resource allocation, Water utilization, Water quality, Projects, Federal government, Administrative agencies, Flood control, Water control, Competing uses, Water rights, Withdrawal, Publications.

The primary responsibility for managing water rests with the states. This includes allocating water among competing uses, protecting rights to water, controlling withdrawals, preventing water pollution, and making water available to support the maximum economic development. The federal government has led in river basin planning and in the construction of large projects. The amount of state participation in meeting water needs varies widely. The most successful states have a strong program of: (1) basic data collection; (2) planning; (3) policy development; (4) implementing legislation; and (5) public education. The progressive states have provided leadership in solving their problems through strong financial support and by attracting staffs skilled in engineering, economics and law. They have developed an active partnership with both local units of government and the federal agencies. While the responsibility for policy making is not always centralized, it is clearly defined and carried out with close cooperation between the legislative and executive departments of state government. (Childs-Fla)
W69-09581

CONGRESS AND THE NATION'S WATER RESOURCES,
Walter Rogers.
ABA Section of Mineral and Natural Resources Law (1962 Proceedings), p 113-119, 1962. 7 p.

Descriptors: *Federal-state water rights conflicts, *State governments, *Federal Government, *Water rights, Political aspects, Local governments, Desert Land Act, Legislation, Public lands, Unappropriated water, Federal reclamation law, Water resources development, Navigable waters, Legal aspects, Governments.

The author discusses the problem of the federal government versus the state governments with reference to water rights. He discusses the historical background of the problem detailing the evolution of federal control over navigable waterways and federal activity in the area of flood control. Since World War II federal activity in the field of water resources has expanded to encompass virtually every phase of water resources development. The author then delves into the potential conflicts between state and federal government in respect to water rights. The fear in western states has arisen that the federal government proposed to take away without compensation, existing water rights secured under state law. Various congressional efforts to resolve the problem have been attempted and the author outlines these efforts. The author concludes with a plea to the legal profession to abandon the role of advocate of a position on the issue to study it objectively, and then to join with the Congress in finding a solution to the federal-state conflict over water. (Shevin-Fla)
W69-09582

ALABAMA RIVER DEVELOPMENT AUTHORITY.
Ala Code tit 55 secs 373 (6f) - 373 (6j) (1960), as amended, (Supp 1967).

Descriptors: *Alabama, *Administrative agencies, *Water resources development, *River systems, Legislation, Regulation, Local governments, Administration, Coordination, Planning, Water policy, Water allocation (Policy), Rivers, Channels, Surveys, River basin development.

Alabama's water resources are of major importance for the industrial development and economic expansion of the state. To further these goals, the Alabama River Development Authority is created to develop the state rivers and waterways. The Alabama River Development Authority has the following powers and duties: (1) to contract with local governments in order to make studies and surveys of the state river system; (2) to investigate and make surveys of the state river system and to secure development of an inland waterway system; (3) to cooperate with local governments and organizations and to encourage efforts to secure development of state rivers; (4) to aid in securing federal legislation supporting river development and to secure federal funds; (5) to promulgate rules and regulations; and (6) to exercise such appropriate powers as will enable the accomplishment of the promotion, planning, and engineering of river and waterway development. Funds are appropriated to carry out the provisions of this article. (Childs-Fla)
W69-09583

STATE LABORATORY OF HYGIENE.
For primary bibliographic entry see Field 05F.
W69-09584

RIVERS AND CREEKS.
N C Gen Stat secs 77-1 - 77-14 (1965), as amended, (Supp 1967).

Descriptors: *North Carolina, *Rivers, *Channel improvement, *Obstruction to flow, Legislation, Local governments, Regulation, Administrative agencies, Streams, Slopes, Dams, Fish passages, Gates, Mill dams, Lumbering, Bridges, Navigable waters, Fish guiding, Drainage ditches.

The Board of County Commissioners may appoint commissioners to perform various functions concerning rivers or streams running through the county. The commissioners shall clear and lay off rivers and creeks in their respective counties leaving three-fourths of such waters for the owners for erecting slopes, dams and stands and one-fourth for the passage of fish in such rivers or streams. The owner of any mill shall maintain a gate and slope to be used for floating logs. Any stream used to propel machinery which becomes diverted may be returned to its channel. Any person owning a boat plying any river or creek which might be considered non-navigable may make a draw in any bridge which obstructs passage. The Board of County Commissioners may establish public landings on any navigable stream or watercourse in the county. Obstructing free passage of boats along any river or creek is a misdemeanor. Lessening the natural flow of water along a natural water passage by obstruction is a misdemeanor. However, the erection of fish dams or hedges not extending across more than two-thirds of the width of any stream is lawful. The obstruction of streams and drainage ditches whereby the drainage is impeded is unlawful. (Childs-Fla)
W69-09585

BRINKLEY V EATON (RESPONSIBILITY FOR NATURAL ALTERATION OF FLOW).
39 So 2d 491-494 (Miss 1949).

Descriptors: *Mississippi, *Surface waters, *Relative rights, *Alteration of flow, Land tenure, Judicial decisions, Surface runoff, Surface drainage, Canals, Ditches, Drainage, Diversion structures, Water conveyance, Natural flow.

Complainant and defendant owned large tracts of adjacent land. Defendant's land was bounded on one side by an artificial canal. For years a natural watercourse flowed across complainant's land onto defendant's land and then turned naturally back onto other land of complainant. In 1912, the canal and an artificial ditch were dug on defendant's land diverting the natural water from its course. The ditch continuously filled and overflowed despite defendant's efforts to keep it clear after his acquisition of the land in 1941. Complainant claimed damages from the natural water which had reverted to its original course and sought an injunction to force defendant to maintain the artificial ditch. On appeal from dismissal of the complaint, the Supreme Court of Mississippi held due to the topography of defendant's land, it would impose too great a burden upon him to require restoration of the ditch. The court held an owner of land was not required to maintain artificial drains when acts of nature made it unreasonable or impossible. (Harris-Fla)
W69-09586

WATER AREAS BEAUTIFICATION.
W Va Code Ann, sec 20-5-14 thru 20-5-16 (1966).

Descriptors: *Water pollution sources, *West Virginia, *Water resources development, *Water pollution, Rivers, Legislation, Streams, Basins, Lakes, Ponds, Watercourses (Legal), Water policy, Regulation, Water pollution control, Waste disposal, Legal aspects.
Identifiers: Penalties (Civil), Penalties (Criminal).

The Division of Water Resources is responsible for the department's program for husbandry of water areas (except farm ponds) and the immediately adjacent lands. The chief of the division makes surveys, conducts public meetings, and takes such other steps as may be expedient to improve all such water areas. He cooperates with the department's chief law enforcement officer and all other proper law enforcement agencies in enforcing the provisions of the law prohibiting the disposal of litter in or near such water areas. It is unlawful to deposit or cause to be deposited any litter in a water area or within one hundred yards thereof, or in such location that high water or normal drainage conditions will cause the material to be washed into any such water area. This does not restrict an owner's use of his private property nor the disposal of industrial wastes consistent with the provisions of article five A of this chapter. If an owner dumps materials so that high water or normal drainage conditions cause them to wash into a watercourse, it will be prima facie evidence that the owner intended to violate the provisions of this section. The provisions of this article are severable. (Gabrielson-Fla)
W69-09587

JURISDICTION OF COUNTY LYING ON NAVIGABLE RIVER.

Md Ann Code art 75 secs 81, 82 (1957).

Descriptors: *Maryland, *Jurisdiction, *Navigable rivers, Legislation, Local governments, Legal aspects, Political aspects, Channels, Boundaries (Property).

Counties lying on navigable rivers shall extend their jurisdiction from the shore to the channel of the river that divides the counties except where a dividing line has been fixed by law. The jurisdiction of every county bounded at any point by navigable waters shall extend from the shore to the inside of the channel, which shall be regarded to be the center of said waters, except where said waters adjoin neighboring states, in which case the jurisdiction shall continue to the ultimate limits of the state. (Childs-Fla)
W69-09588

WATER AND SEWERS.
Md Ann Code art 23B, secs 78-92 (1966), as amended, (1968).

Descriptors: *Maryland, *Cities, *Water supply, *Drainage, Sewage, Municipal wastes, Sanitary engineering, Sewers, Sewage treatment, Cesspools,

Sewage disposal, Pipelines, Conduits, Drainage systems, Storm drains, Leakage, Water pollution, Water rates, Water wells, Surveys, Condemnation, Public health, Gutters, Taxes, Boundaries (Property), Plumbing, Maintenance.
Identifiers: *Sewerage systems.

Any city may construct and maintain water systems, sewerage systems and drainage systems, and do all things necessary for the efficient operation of such systems. Any company placing or changing any structure in the public way must receive authorization from the city. Any structure impeding the city water pipes may be ordered removed by the city, and they can use their condemnation power if necessary. The city may enter upon the county public way for the purposes of constructing or maintaining its water systems without obtaining a permit. The city shall provide connections with water and sewer mains for abutting property owners and may order existing cesspools and wells filled for the benefit of public health. A uniform charge may be levied for these connections. The city may require changes in plumbing to prevent waste or improper use of water. The city may prohibit the operation of private water systems and provide for the sanitary maintenance of other private sewage systems. The city may extend its systems beyond the town boundaries. City employees may enter private property to examine the water systems. No person shall pollute water used in the water supply. Service rates for water may be charged and special assessments levied to pay for the systems. (Shevin-Fla)
W69-09589

DRAINAGE DISTRICTS.

Md Ann Code art 25, secs 96-122 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Drainage districts, *Reclamation, *Drainage programs, Swamps, Marshes, Public benefits, Highways, Legislation, Ditches, Canals, Levees, Watercourses, Costs, Assessments, Cost-benefit analysis, Federal government, State governments, Loans, Feasibility studies, Local governments, Legal aspects.

County commissions are authorized to establish drainage districts upon petition of a majority of the landowners in the proposed district. The commission shall appoint a board of viewers to establish the feasibility, costs, and benefits of such a district. If the viewers' report is favorable the district shall be established and a board of drainage commissioners appointed to supervise drainage construction, assess costs, and issue bonds for the project. The districts are authorized to utilize federal funds that may become available for their projects upon approval of affected landowners. A state 'Drainage District Fund' is created to provide loans to aid in defraying initial costs of drainage district projects. (Kahle-Fla)
W69-09590

DRAINAGE DISTRICTS.
Md Ann Code art 25 secs 96-99 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Drainage districts, *Reclamation, *Drainage programs, Surveys, Public benefits, Cost-benefit analysis, Ditches, Canals, Watercourses, Levees, Drainage, Swamps, Marshes, Cultivation, Administrative agencies, Administrative decisions, Feasibility studies, Legislation, Engineers estimates, Costs, Cost analysis, Drainage engineering, Legal aspects.

The county commissioners of any county may establish levees or drainage districts and construct or improve ditches, canals, watercourses or pumping plants in order to drain and reclaim swamplands. Whenever a majority of the landowners in a proposed district or owners of 3/5 of the land to be affected by the proposed improvements petition to the county court setting forth the location of the land and alleging that the land is too wet for cultivation and will be benefited by draining, ditching or leveeing and there is filed a bond in the amount of $50 per mile for such improvement, the clerk shall issue a summons to all non-signing landowners. Upon the return day the commissioners shall appoint a civil and drainage engineer and two freeholders of the county as a board of viewers to examine the lands and report thereon. The report shall set forth: whether the proposed drainage is practicable, whether it will be of benefit to the general welfare of the community or to a public highway, whether the benefit is sufficient to warrant the probable expenditure, and whether or not all the lands to be benefited are included in the proposed district. If the report is favorable the viewers shall be instructed to make a complete survey, draw plans, and estimate costs. If the report is unfavorable, the petition shall be dismissed. (Kahle-Fla)
W69-09591

DRAINAGE DISTRICTS.
Md Ann Code art 25 secs 100-107 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Drainage districts, *Surveys, *Cost-benefit analysis, Assessments, Highways, Public benefits, Railroads, Legislation, Administrative agencies, Administrative decisions, Drainage programs, Ditches, Canals, Levees, Feasibility studies, Legal aspects, Maps.

The board of viewers shall make a complete survey of the proposed district marking the line of each ditch, drain or levee. A drainage map of the district shall be made showing the location of each improvement and the boundaries of each landowner. Locations of highways, railroads, and incorporated towns shall be set out. The viewers shall also assess damages to any landowners occasioned by the improvements. The benefited land shall be separated into 5 classes from highest benefit to least benefit to be used as a basis for assessment to the landowners. A final hearing shall be set for a date not less than 30 days after acceptance of the report by the commissioners. All non-signing landowners in the proposed district shall be summoned. At the final hearing any landowner may file a written objection to the viewers' report. If the commissioners find that the benefits to the land will outweigh the costs the district shall be established. If not the proceedings shall be dismissed at the cost of the petitioners. (Kahle-Fla)
W69-09592

DRAINAGE DISTRICTS.
Md Ann Code art 25 secs 108-117 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Construction costs, *Assessments, *Drainage districts, Drainage programs, Administrative agencies, Highways, Cost-benefit analysis, State governments, Right-of-way, Drains, Laterals, Financing, Legislation, Costs, Local governments, Projects.

The county commissioners shall appoint three freeholders as the board of drainage commissioners for the established district. The board shall appoint a superintendent of construction and fix his compensation. The drainage commissioners shall ascertain and certify to the county commissioners the total construction costs and bond interest for a period of three years after construction. After the total costs are ascertained the drainage commissioners shall prepare assessment lists for each landowner to cover the period of the bond issue that will finance the project. If any highway or other public property is to be benefited the state shall be assessed for its share of benefits. Lands within the district not benefited shall not be assessed. Rights-of-way for drainage may be aquired by purchase or condemnation. Assessed landowners shall have the right to use the ditch or drain as an outlet for lateral drains. (Kahle-Fla)
W69-09593

DRAINAGE DISTRICTS.
Md Ann Code art 25 secs 118-122 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Construction, *Construction costs, *Drainage districts, Drainage programs, Contracts, Federal government, Loans, Maintenance, Repairing, Assessments, State governments, Local governments, Administrative agencies, Costs, Legislation, Financing, Bids.
Identifiers: Negligence.

The board of drainage commissioners shall advertise for construction bids to be let to the lowest responsible bidder. Whenever an improvement is completed it shall be the duty of the drainage commissioners to maintain and repair the improvement and assess the benefited lands. If repairs are made necessary by the negligence of a particular landowner, he shall be assessed and his lands levied against for the repair costs. The drainage districts are authorized to avail themselves of any federal loan provisions for the operation of drainage districts that may be enacted, but no such agreements between the federal government and the drainage districts shall be valid until a majority of landowners in the district have given written approval to the contract. The 'Drainage District Fund' is established and $10,000 is appropriated from the treasury to this fund for loans not to exceed $2,000 to any one district for expenses incurred up to the time of the establishment of the drainage district. (Kahle-Fla)
W69-09594

RIVERS, HARBORS.
For primary bibliographic entry see Field 05G.
W69-09595

POLLUTION OF SOURCES OF WATER SUPPLY.
For primary bibliographic entry see Field 05G.
W69-09596

LAW ON THE POTOMAC RIVER.

Md Ann Code art 66C secs 306 thru 313 (1957).

Descriptors: *Maryland, *Commercial fishing, *Permits, *Regulation, Fish, Oysters, Crabs, Fyke nets, Gill nets, Nets, Fishing gear, Fish conservation, Navigable waters, Taxes, Legislation, Herring, Jurisdiction, Legal aspects, Virginia, State jurisdiction.
Identifiers: *Potomac River, Shad, Penalties (Civil), Penalties (Criminal).

Citizens of Maryland and Virginia who have been residents for 12 months may take fish, oysters, and crabs from the Potomac River upon compliance with Maryland law. Any citizen fishing for market or profit with pound, fyke, gill, sturgeon or skirt nets, haul seines, weirs or other devices, must obtain a seasonal license from an authorized Maryland officer and pay a prescribed tax. Officers have the right and duty to examine the right of persons taking catches, and may pursue and arrest violators of Maryland law outside the jurisdiction on navigable waters. Offenses may be punished by magistrates or Maryland courts of criminal jurisdiction. The use of certain sizes and types of nets is absolutely prohibited. The use of floating or drift nets or stake gill nets is prohibited except during shad and herring season in designated counties. The failure of persons to comply, or officers to enforce the laws of Maryland shall be punishable by fine and/or forfeiture of equipment as designated in the act. (Harris-Fla)
W69-09597

BOARD OF LEVEE COMM'N V WINEMAN (EMINENT DOMAIN PROCEEDINGS).

222 So 2d 683-685 (Miss 1969).

Descriptors: *Mississippi, *Levees, *Eminent domain, *Administrative decisions, Administrative agencies, Legal aspects, Judicial decisions, Easements, Condemnation, Legislation, Soil structure, Construction, Regulation, Berms, Engineering, Land tenure, Drainage, Excavation, Subsurface waters, Mineral industry, Floods, Flood control, Water management (Applied), Real property.

Plaintiffs had taken fee simple title to defendants' land by eminent domain. The land was taken in order to obtain soil to be used in improving and enlarging levees and for the construction of berm for reinforcement of the levee. Defendants sought to have the taking of fee simple title declared void and only an easement granted. Plaintiffs declared the taking of fee simple title to be of public necessity. The lower court held there was no public necessity for taking fee simple title, but on appeal the supreme court held the plaintiffs had not exceeded their discretion and could take a fee simple title. The court held that any administrative decision by the board would be upheld unless it was shown to be a manifest abuse of their discretion. In this case the evidence showed that the taking of fee simple title was a necessary increment to the efficient operation of the levee. The court found that the plaintiffs had not abused their discretion and could take fee simple title to the land. (Shevin-Fla)
W69-09598

FOOD SANITATION: (SHELLFISH).
NH Rev Stat Ann secs 143:20 thru 143:28 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Regulation, *Shellfish, *Commercial fishing, Legislation, Oysters, Clams, Mussels, Public health, Mollusks, Commercial shellfish, Aquatic animals, Aquiculture, Fish handling facilities, Commercial fish.

The sale of shellfish taken from specified areas is regulated by the Division of Public Health Services of the state of New Hampshire. A certification by the Department of Health and Welfare is required prior to operation of a shellfish processing and packing business. The certificate may be revoked after notice if the establishment is deemed to be unsanitary in the conduct of its operations. Penalties of from twenty-five dollars to not more than two-hundred dollars or imprisonment for not more than sixty days, or both are provided. (Moulder-Fla)
W69-09599

OYSTERS.
Del Code Ann tit 7, secs 2101-2110 (Supp 1966).

Descriptors: *Delaware, *Oysters, *Commercial shellfish, *Regulation, Administrative agencies, Legislation, Water law, Water policy, Commercial fishing, Shellfish, Boundaries (Property), Ownership of beds, Riparian waters, Water rights, Preferences (Water rights), Legal aspects, Jurisdiction, Permits, Beds under water, Riparian rights.
Identifiers: Culling, Limits, Licenses.

One must purchase an appropriate license to take oysters in Delaware, but even with a license it is considered larceny to take oysters from the bottom or plantation of another. Oysters may not be taken at night. Plant and seed oysters taken in tributaries of the Delaware Bay must be culled and thrown back where they are caught. Twenty-five bushels per day is the limit on oysters in such waters and enforcement officials may board any boat taking oysters for inspection of such limit and to see that oysters are properly culled. Oysters may be planted in certain areas if the owner of such beds marks them with stakes. Another method of obtaining exclusive rights to oyster on a bed is to lease the bed from the state. (Johnson-Fla)
W69-09600

HIGHWAYS: (HIGHWAYS, ROADS, AND BRIDGES GENERALLY).

Del Code Ann tit 17, secs 504, 511 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Drainage, *Flood control, Drainage systems, Ditches, Drains, Streams, Creeks, Culverts, Sewers, Damages, Jurisdiction, Flood protection, Water control, Channel improvement, Bridges, Administrative agencies, Legislation.

The Highway Department may maintain free passage of water for the drainage of any road, bridge, or causeway under its jurisdiction. To accomplish this objective, the Department may enter lands adjacent to a road or causeway for the maintenance or repair of any drainage system. Damages sustained by the owner of the adjacent land as a result of Road Department action are to be adjusted by agreement between the Department and the owner or by the Court of Common Pleas. Provisions regarding the wilful or negligent damage to any public bridge or drain, or any appurtenance maintained and used for the convenience or safety of the public are set forth. The injuring party is to forfeit and pay double damages. The action for damages is to be brought in the name of the state with all money being paid to the state treasurer. (Moulder-Fla)
W69-09601

DELAWARE MEMORIAL BRIDGE.
Del Code Ann tit 17, secs 301, 306, 308, 323 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Regulation, *Bridges, *Bridge construction, Legislation, Condemnation, Submerged land, Land use, Eminent domain, Jurisdiction, Riparian rights, State governments, Land appraisal, Pollution, Beds under water, River beds, Delaware River, Administrative agencies, Ownership of beds, Construction costs.

Delaware may purchase property within the states of Delaware and New Jersey for the construction, maintenance, and operation of the Delaware Memorial Bridge and all approaches thereto. Delaware consents to the use of its lands under the Delaware River which are deemed necessary to the construction and operation of such bridge. The attendant power to collect and pledge tolls is also set forth, along with the purposes to which the monies so collected shall be put. (Moulder-Fla)
W69-09602

SOIL CONSERVATION DISTRICTS PROJECTS.
NH Rev Stat Ann secs 481:25-481:28 (1968).

Descriptors: *New Hampshire, *Soil conservation, *Watershed management, *Water management (Applied), Governments, Financing, Costs, Legislation, Legal aspects, Water law, Federal government, Local governments, Soil management, Water conservation, Flood control, Water policy, Administration, Dam construction, Allotments, Government finance, Participating funds.

To cooperate fully with federal agencies in watershed management all jointly sponsored soil conservation district's projects are declared projects under provisions of this chapter and all property and rights acquired for such projects which are nonrevenue producing are tax exempt. The water resources board shall cooperate with cities and towns in the development of small-watershed projects as planned by the soil conservation service of the United States Department of Agriculture and local sponsoring organizations. The exercise of eminent domain, however, may not be applied to any lands needed to allow the enlarging of a dam beyond the height or length needed solely for flood control purposes. Upon review and approval by the state soil conservation committee, state financial aid for such projects is available through the small-watershed fund, provided the town joining in the project matches equally such funds. When highways must be relocated due to such projects the cost will be paid bythe sponsoring agency. (Johnson-Fla)
W69-09603

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
NH Rev Stat Ann secs 481:1-481:21 (1968).

Descriptors: *New Hampshire, *Administrative agencies, *Dams, *Water conservation, Legislation, Water law, Water policy, Legal aspects, Administration, Jurisdiction, Financing, Judicial decisions, Public health, Economics, Local governments, Federal government, Reservoirs, Flood control, Impounded waters, Interstate compacts, Contract administration, Maintenance, Management, Projects, Gaging stations.

Conservation and distribution of water is in the public interest and thus requires projects for the conservation, development, storage, distribution,and utilization of water. The New Hampshire Water Resources Board has the power to engage in projects within the state and in cooperation with other states and the federal government to meet these needs. The management and general powers of the board are set out in detail with special reference to the board's powers to make certain contracts, acquire certain property, and change the locations of highways and bridges in connection with such projects. Regulations for reservoir operation and delineation of types of unlawful use of 'stored water' preceed a number of financial provisions relating to tax exemption of properties used in the construction and maintenance of dams and reservoirs, bond authorization, and remedies available to such bondholders. There is provision for the entrance into certain interstate compacts as well as for cooperation with the federal government in the establishment and maintenance of stream flow gauging stations. (Johnson-Fla)
W69-09604

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
NH Rev Stat Ann secs 481:1-481:3 (1968).

Descriptors: *New Hampshire, *Water conservation, *Water policy, *Administrative agencies, Administration, Water law, Legal aspects, Legislation, Financing, Economics, Water utilization, Flood control, Projects, Governments, Regulation, Water resources development, Water resources, Dams, Reservoirs.
Identifiers: Corporations (Public).

There is a state wide need for the conservation and distribution of water and the regulation of the flow of rivers and streams. The public interest, welfare, and necessity requires the construction of projects for these purposes to lessen flood damage and to promote the state's economic welfare by enhancing the present and potential water power along rivers through the construction, maintenance, and operation of dams and reservoirs. A public corporation known as the New Hampshire Water Resources Board has power to engage in such projects. Among the specific powers of the Board are the following: purchasing, condemning, leasing or otherwise obtaining property for the state as deemed necessary for its corporate purposes; constructing and maintaining projects; charging and collecting fees for water use; paying surplus revenues into the state treasury; exercising its powers in adjoining states as permitted by law; borrowing money; and making and issuing negotiable notes and bonds. (Johnson-Fla)
W69-09605

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.

NH Rev Stat Ann secs 481:4-481:10 (1968).

Descriptors: *New Hampshire, *Administrative agencies, *Projects, *Water conservation, Judicial decisions, Administration, Legislation, Legal aspects, Water law, Political aspects, Water policy, Contract administration, Contracts, Economics, Eminent domain, Regulation, Financing, Jurisdiction.

The corporation is managed by five directors with special restrictions as to political affiliation and salary. The corporation has the general powers of New Hampshire Corporations and may accept cooperation from the United States or its agencies. The board, before commencing any project, must submit a detailed description and plan to the governor and council for their approval. Upon an order from the governor and council directing the board to proceed with a project, the board shall complete contracts with such persons or corporations as may be specially benefitted by such projects, including users of water in and outside the state for power and other purposes, covering terms under which such persons or corporations shall pay for such benefits. There is provision for a judicial determination in the superior court of reasonable compensation for such use when either a user declines to enter into such a contract or where the parties cannot agree on the amount of compensation for such use. The corporation may purchase or otherwise acquire for just compensation such real property as is necessary for a project. (Johnson-Fla)
W69-09606

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
NH Rev Stat Ann secs 481:11-481:14-a (1968).

Descriptors: *New Hampshire, *Local governments, *Water policy, *Water conservation, Legislation, Legal aspects, Water law, Contracts, Water utilization, Reasonable use, Riparian rights, Administration, Administrative agencies, Riparian land, Flow control, Flood control, Flow rates, Water control, Reservoirs, Economics, Taxes, Government finance, Judicial decisions, Jurisdiction.

When the corporation fails to agree with a municipal government on the appropriate relocation of a highway, bridge, electric transmission or distribution line, it may institute proceedings in the county superior court which will order such arrangements as justice may require. It is unlawful for any person to willfully use 'stored water' for power or other purposes, if he is not entitled to its use by contract. It is also unlawful for any person to willfully interfere with the flow of any stored water except as is necessary in making reasonable use of such water under contract or decree or incident to the reasonable use of the natural flow in the exercise of rights as a riparian or littoral proprietor. The corporation regulates the storage and release of water from each reservoir in an attempt to minimize damages from floods and to promote the state's economic and industrial welfare. All property rights acquired by the corporation are exempt from all taxation, but the corporation will make payments to each town from which property rights were acquired equal to the current local tax rate on such property. (Johnson-Fla)
W69-09607

STATE DAMS, RESERVOIRS AND OTHER WATER CONSERVATION PROJECTS.
NH Rev Stat Ann secs 481:15-481:21 (1968).

Descriptors: *New Hampshire, *Administrative agencies, *Financing, *Governments, Local governments, Federal government, Legislation, Water law, Water policy, Legal aspects, Political aspects, Jurisdiction, Judicial proceedings, Investment, Interstate compacts, Public health, Water conservation, Flow control, Flowmeters, Gages.

By resolution, the board may authorize the issuance of bonds for the purpose of paying the cost of any such projects as it may sponsor. Such bonds are payable only from the revenue of the corporation and are not a debt of the state or any of its political subdivisions. In the event that the corporation defaults in payment of principal or interest on any of its bonds a receiver is appointed to gather necessary assets of the corporation and to make payments to bondholders. The governor with the advice and consent of the council may in the name of the state guarantee the principal and/or interest of any bonds issued by the corporation. In a similar manner the governor may enter into agreements or compacts with other New England states for the purpose of promoting public health and safety by conserving and regulating river flow, lessening flood damage and preventing pollution. The board cooperates with the United States Geological Survey in the establishment and maintenance of stream flow gauging stations for informational purposes. (Johnson-Fla)
W69-09608

COASTAL FISHERIES LAWS.
SC Code Ann secs 28-752 thru 28-761 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Fishing, *Regulation, *Public rights, Fish, Bays, Rivers, Streams, Marshes, Leases, Legislation, Legal aspects, Permits, Ownership of beds, Beds, Tidal waters, Saline water, Fish conservation, Saline water fish, Administrative agencies.

All waters and tideland bottoms of bays, rivers, creeks, and marshes in the state or within three miles of the coast shall remain as a common to the people for fishing. This does not include waters and bottoms previously conveyed by the state. Minimum sizes of various fish to be bought and sold are established. It is unlawful to use edible fish except for food or bait. The South Carolina Water Resources Commission may prescribe regulations and require permits for all fishing. No lessee of a bottom may mark his leased area with a sign without the Commission's authority. A natural-born citizen with a sheriff's operator certificate must be aboard any shrimping or fishing boats while in operation. The statute sets forth penalties for violations. These provisions do not apply to fish or fishing in fresh waters. (Breeze-Fla)
W69-09609

FOLEY V STATE (DAMAGES FOR ELIMINATION OF WATER SUPPLY).
299 NYS 2d 864-866 (1969).

Descriptors: *New York, *Water supply, *Irrigated land, *Appropriation, Irrigation, Damages, Land appraisal, Land classification, Land use, Condemnation value, Water costs, Water loss, Judicial decisions, Legal aspects, Water law, State governments, Water resources, Water sources, Property values, Land.

An appropriation of lands for highway purposes by the state eliminated the water supply source, derived from an old gravel pit, which served to irrigate some 39.74 acres of claimants' lands. The court of claims awarded damages to claimants, and the state appealed. In the lower court claimants' appraiser attributed $1000 to the loss of the water supply, but he also depreciated the value of the 39.74 acres by $25 per acre or $990 because of the loss of irrigation. The appraiser subsequently admitted that the $1000 item represented the estimated cost of a new water supply and that the $990 item only represented the factor of the loss of irrigation. The supreme court held that this cost-to-cure estimate was duplicative of the depreciation item and had to be deducted from the total award. (Carruthers-Fla)
W69-09610

MOREY V STATE (LIABILITY FOR HIGHWAY CHANGE OF GRADE).
297 NYS 2d 820-825 (NY App Div 1969).

Descriptors: *New York, *Surface runoff, *Artificial watercourses, *Highways, Highway relocation, Damages, Road construction, Grading, Appropriation, Channeling, Judicial decisions, Legislation, Overflow, Eminent domain.
Identifiers: *Negligence.

Damages were sought against the state for their negligent construction of a highway grade and the appropriation of claimant's land. The state re-constructed a highway in front of claimant's property. In changing the highway grade water and dirt was caused to flow onto claimant's property and into his building's basement. The lower court awarded $3500.00 based upon the de facto appropriation of claimant's land. The appellate division reversed the lower court indicating that claimant failed to state a cause of action. It was not proven that the reconstructed highway was negligently constructed. The court said that the state is not liable for damages for change of grade unless a specific statute permits recovery or artificial channeling promotes and directs the flow of water. No evidence showed such artificial channeling and the claim for appropriation was not accompanied with substantial proof. (Holt-Fla)
W69-09611

STATE AUTHORITIES EMINENT DOMAIN ACT.

SC Code Ann, secs 25-52, 25-53, 25-64 (1962).

Descriptors: *South Carolina, *Eminent domain, *Riparian rights, Real property, Condemnation value, Condemnation, Powerplants, Dams, Canals, Locks, Reservoirs, Reclamation, Swamps, Reforestation, Watersheds (Basins), Public benefits, Easements, Right-of-way, Legislation, Water rights, Damages, Hydroelectric plants.

All state authorities are empowered: to develop waterways of the state; to construct and maintain powerhouses, dams, canals, locks and reservoirs; to reclaim and drain swamps and flood lands; to improve health conditions; and to reforest water sheds shall have the right of eminent domain. The right of condemnation shall include the right to acquire land and water rights for the above purposes. Unless otherwise indicated all property taken will be subject to the owner's right of ingress and egress. If the state does not utilize condemned property for the above purposes within 5 years then the former owner shall have the right to repurchase and recover damages. All lands previously acquired for public purposes are subject to this chapter. Questions of compensation and special damages shall be determined in accordance with prevailing principles of law. Public electric utility property, however, shall be condemned only if it is to be incorporated with a proposed electric utility. (Holt-Fla)
W69-09612

KOCIAN V DEVITO (IMPLIED WARRANTY IN DIGGING WELL).
5 Conn Cir 399, 251 A2d 516-519 (1968).

Descriptors: *Connecticut, *Contracts, *Artesian wells, *Damages, Wells, Drilling, Negotiations, Legal aspects, Judicial decisions, Remedies, Consumptive use, Potable water, Water yield, Relative rights, Water quality, Water wells.

Plaintiff, an artesian well-drilling contractor, brought suit to recover the balance due for services and materials furnished to defendants in fulfilling three contracts to dig wells. The first two wells had produced water of either insufficient quantity or unsatisfactory quality. The third well produced water adequate in both quantity and quality. The trial court awarded damages less than the balance due because in its opinion, the parties seemed to contemplate some sort of negotiated settlement since the first two wells were unsatisfactory. Plaintiff appealed. The appellate court set aside the judgment and remanded with directions to award

to plaintiff the full balance due. Absent any guarantee by the driller, there is no implied warranty as to the quality or quantity of the water a well might produce. No evidence was presented to show plaintiff made any such guarantees. Even if the trial court accepted defendants' testimony that there was some vague mention of compromise, no actual discussion of compromise even took place and there was no agreement to reduce any prices due. (Gabrielson-Fla)
W69-09613

AALSBURG V CASHION (ALLOCATING ACCRETION AMONG RIPARIAN OWNERS).
165 NW 2nd 309-314 (Ct App Mich 1969).

Descriptors: *Michigan, *Boundaries (Property), *Accretion (Legal aspects), *Lake shores, Lakes, Shores, Riparian rights, Judicial decisions, Remedies, Legal aspects, Relative rights, Riparian land.

Plaintiffs, defendants, and third party defendants all owned adjoining lots fronting on a lake. Over the years the water level of the lake had gone down causing substantial accretion in front of these lots. The court was asked to determine the property lines between plaintiffs' and defendants' premises and between defendants' and the third party defendants' premises in relation to this accreted land. The trial court determined that up through 1942 the parties acquiesed in an extention of their side lot lines in setting common boundaries over accreted lands. The courts extended these boundaries from the 1942 shoreline to the imaginary center point of the lake. Plaintiff appealed. The appellate court ruled that there was insufficient evidence to permit a finding of acquiescence to extending the side lot lines to the 1942 shoreline. It ruled that the accretion could be properly allocated by finding the original side lot lines nearest the disputed property, extending those lines to the new shoreline and then in a straight line to the center of the lake, and by dividing the new shoreline within those lines in direct proportion to the front footage of the original lots. (Gabrielson-Fla)
W69-09614

FARNES V LANE (RIGHTS INCLUDED IN AN EASEMENT).
161 NW 2d 297-301 (Minn 1968).

Descriptors: *Minnesota, *Ri parian rights, *Easements, *Legal aspects, Judicial decisions, Right-of-way, Docks, Lake shores, Boating, Recreation, Land use, Severance, Relative rights, Access routes.

Plaintiff, a lake shore landowner, sought a declaration that defendant's right-of-way over the plaintiff's lakeshore property provided access to the lake only. Defendant claimed that his right-of-way entitled him to build a dock, moor a boat, and store equipment beside the dock. The Supreme Court of Minnesota sent the suit back for a new trial saying that new evidence was needed to decide plaintiff's and defendant's rights. The court said that an easement was not an estate in land, and that an estate in land was needed before there could be riparian rights. Thus the defendant was not a riparian owner since he had no estate in land just the easement. But the court stated that a grantee of an easement might have the right to install a dock, moor a boat, and store equipment near the dock if he could show that the circumstances of the grant of the easement contemplated these rights. The court suggested certain questions to be answered at the new trial to determine if the disputed rights were included in the easement. (Gadd-Fla)
W69-09615

THE STATE COLLEGE AND UNIVERSITY (POWER OF TRUSTEES TO ACQUIRE WATER RIGHTS).
NH Rev Stat Ann sec 187:8 (1964).

Descriptors: *New Hampshire, *Water utilization, *Water management (Applied), *Water works, Water conveyance, Water delivery, Domestic water, Industrial water, Water costs, Water sources, Water storage, Water supply, Water users, Sewers, Sewage disposal, Culverts, Conduits, Reservoirs, Surface drainage, Valves, Pumps, Gates, Legislation, Sanitary engineering.

The trustees shall have the following powers: (1) to acquire water by purchase or otherwise, construct reservoirs or water towers, erect pumping machinery, lay water mains and install gates, valves and hydrants; (2) to furnish and sell water for fire protection and industrial or domestic use to manufacturers, private corporations, and individuals; and (3) to construct sewers, culverts, conduits, and pipes with all necessary appliances for surface, under surface, and sewage drainage for the health and comfort and sanitary improvement of the town of Durham and its inhabitants. (Shevin-Fla)
W69-09616

MUNICIPAL AND COUNTY GOVERNMENT (WATER WORKS).
Vt Stat Ann tit 24, secs 3301-3316 (1959).

Descriptors: *Vermont, *Water supply, *Water works, *Water distribution (Applied), Legislation, Regulation, Pipelines, Artesian wells, Reservoirs, Water rights, Utilities, Equipment, Water control, Water rates, Aqueducts, Water contracts, Water allocation (Policy), Water utilization, Cities, Public utilities, Financing.

A municipal corporation is authorized to construct, maintain and repair artesian wells, reservoirs, pumps, engines and apparatus and to purchase or acquire, any artesian wells, ponds, springs, streams, watercourses, real estate, water rights, flowage rights, and easements necessary to provide a water supply. For these purposes, the corporation may enter upon and use any land to lay and repair aqueducts and pipes. Agreement as to just compensation may be entered into with respective property owners. In lieu of agrement, the matter may be set before a board constituted by the court of chancery, which shall assess and award just damages. Any person who uses the water provided by the municipal corporation shall be required to pay. Any person who diverts the water, bathes therein, injures or destroys any artesian well, dam, embankment, aqueduct, pipe reservoir, conduit, hydrant, structure pump or other machinery held, owned, or used by such municipal corporation shall be liable to said corporation for treble damages. Said municipal water corporation may issue bonds and may establish water rates, the moneys received to be used to pay the interest upon the water bonds of the corporations. The money received from the operation of the municipal water department shall not be used for any other purpose until all such bonds have been paid. (Moulder-Fla)
W69-09617

MUNICIPAL AND COUNTY GOV'T (SEWAGE SYSTEM).
For primary bibliographic entry see Field 05G.
W69-09618

WATER SUPPLY FACILITIES; FLOOD CONTROL; WATER MANAGEMENT.
Ill Ann Stat ch 19, secs 1024-1 thru 1024-4, 1025-1 thru 1025-2, 1026-1 thru 1026-5 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Flood control, *Water management, *Financing, Water supply, Construction costs, Waterworks, Administrative agencies, State governments, Cities, Local governments, Loans, Government finance, Project planning, Construction, Economic justification, Legislation, Planning, Water resources development, River basin development, Reservoirs, Dams.
Identifiers: Bond issues, Pure Waters Board, Matching funds, Government grant, Department of Public Health.

The Pure Waters Board is authorized to allocate state funds to municipalities and inter-municipal and inter-state agencies for the construction and expansion of waterworks and water supply systems. The Board shall consult with the Department of Public Health and appropriate planning commissions in determining the grant's necessity. A grant must be matched by local funds, and it cannot exceed 30% of the project cost. An application for a grant should include a report from the planning commission having jurisdiction in the project area. The facilities for which the grant is made must meet the requirements of the public health department. The Board may make loans for these same purposes. The Board may finance state flood control projects which shall include the acquisition and construction of dams, reservoirs, drains, pumps, levees, flood walls, and related works and facilities. The board may finance land acquisition for the construction and development of state water resources projects including dams, reservoirs, and other water management works and facilities for water supply. The Board may also finance state participation in federal water resources projects. Grants to finance planning programs may be given to the River Basin Planning Commissions. (Gadd-Fla)
W69-09619

CANALS AND WATERWAYS.

Ill Ann Stat ch 19, secs 126a-128.3 (Smith-Hurd 1963).

Descriptors: *Illinois, *Administrative agencies, *Watershed management, *Flood protection, Water policy, Watersheds (Basins), Rivers, Flow, Regulation, Planning, Surveys, Construction, Maintenance, Drainage, Costs, Contracts, Coordination, Administration, Project planning, Condemnation, Easements, Powerplants, Surplus water, Floods, Flood control, Legislation, Legal aspects, Drainage districts, Surface waters.

The many adverse effects of unregulated river flow necessitate a state policy regulating flood and low water flows. The Department of Public Works and Buildings may make surveys and plans, construct, maintain, and operate all works to control floods, improve drainage, and conserve low water flows in any river or watershed. All necessary expenditures must be authorized by the legislature and conform to an approved report of survey sent to various government officials containing stipulated data. The Department may implement the construction by letting contracts or by direct employment. In order to carry out these duties, the Department may enter into agreements and acquire, through any lawful means including condemnation, any lands and easements necessary. The Department may operate powerplants to utilize surplus waters. In a flood emergency the Department may expend funds for flood relief in conformity with a report of survey; or if no approved report of survey exists, for the restoration of the flood control works. It is state policy to implement watershed protection for flood control and other benefits. The state Department of Agriculture may enter into agreements for planning and engineering watershed improvements. (Breeze-Fla)
W69-09620

CHICAGO REGIONAL PORT DISTRICT.
Ill Ann Stat ch 19, secs 155a, 156 (Smith-Hurd 1963).

Descriptors: *Illinois, *Harbors, *Port authorities, *Navigable waters, Piers, Docks, Structures, Permits, Legislation, Regulation, Shores, Administrative agencies, Landfills, Beds, Beds under water, Land use, Construction, Basins, Planning, Navigation, Obstruction to flow, Boats, Ships, Legal aspects.

Changes and modifications in existing harbor plans within the area of the Chicago Regional Port District recommended by the District or development plans for the port facilities adopted by the District

must be approved by the Department of Public Works and Buildings. Such approval shall be conclusive evidence of compliance with the requirements of this act. No such changes shall be approved which reduce the area of Lake Calumet Harbor to less than 500 acres or a basin thereof to less than 300 acres. The deed made by the city of Chicago to the Port District of land in and near Lake Calumet is hereby confirmed excepting such lands as fall within Calumet Harbor. If any future modifications change the area of said Harbor, the District shall have all the right, title, and interest to such lands above excepted as thereafter cease to form part of the harbor. The Port District has power to issue permits for the erection of any structure within 40 feet of navigable waters within the District and for the deposit of any material in said waters, to remove obstructions, and to establish dock, shore, and harbor lines. (Kahle-Fla)
W69-09621

MAKING DRAINS, ROADS OR RAILROADS.
For primary bibliographic entry see Field 05G.
W69-09622

REGULATING AND MEASURING WATER-POWER.
Ill Ann Stat ch 92, sec 12 (Smith-Hurd 1966).

Descriptors: *Illinois, *Hydroelectric power, *Equitable apportionment, *Contracts, Dams, Regulation, Water measurement, Water delivery, Weirs, Water allocation (Policy), Legislation, Legal aspects, Water control, Water supply, Preferences (Water rights), Water contracts, Water distribution (Applied), Water utilization, Instrumentation, Hydroelectric plants.

Where different persons have the right to use the water or water power of a river dam, the dam owner and any such person may fix some fair and reasonable plan of measuring and delivering the water or water power. This regulation, once recorded, is binding on all entitled to use the water or water power provided the regulations apportion each person his just share fairly. (Breeze-Fla)
W69-09623

COUNCIL V CLARK (BOUNDARY LINE DISPUTE).
441 SW 2d 472-474 (Ark 1969).

Descriptors: *Arkansas, *Boundaries (Property), *Boundary disputes, *Streams, Legal aspects, Judicial decisions, Water rights, Non-navigable waters, Land, Land tenure, Land resources, Relative rights, Barriers, Natural streams, Construction costs, Gates, Drainage, Conservation.
Identifiers: *Fences, Thread of the creek.

Appellants conveyed a portion of their property to one Millard Wright, appellee's predecessor in title. Shortly after the original conveyance a fence was constructed along the south bank of a creek which ran between the two tracts of land. Appellants contended this fence was meant to be a boundary divider. Wright denied this, claiming that appellants were to share the cost of construction and that a water gate was to be built across the creek. In 1959, Wright conveyed the land to the appellees reserving one-half the mineral rights for himself. Testimony showed that appellants had cleared the north bank but that nothing had been done to the south bank. The trial court found the fence was one of convenience and not a boundary fence. The boundary line was determined to be the thread of the creek and this appeal followed. The supreme court affirmed, holding that the under the deed title extended to the middle of the creek. The court stated that the burden of proof of showing that a different boundary line than that described in the deed was intended was on the appellant and that his burden was not met. The court determined that the fence was built as close to the natural barrier as possible and had not become a boundary line by acquiescence. The court also discounted appellant's claim that he had acquired the property by adverse possession. (Shevin-Fla)
W69-09624

BRADY V SPRINGDALE (CONDEMNATION ACTION FOR DESTRUCTION OF SPRINGS).
For primary bibliographic entry see Field 05G.
W69-09625

CONSERVATION DISTRICT ACT.
For primary bibliographic entry see Field 03D.
W69-09626

CONTRACTS BY CITIES WITH UNITED STATES REGARDING FLOOD CONTROL PROJECTS.

Ill Ann Stat ch 24, secs 866h1, 866h2, 866h3 (Smith-Hurd 1962).

Descriptors: *Illinois, *United States, *Contracts, *Flood control, Legislation, Project planning, Financing, Cities, Regulation, Right-of-way, Bridges, Pollution abatement, Damages, Flood protection, Construction, Cost sharing, Operation and maintenance, Channels, Federal Government, Local governments, Legal aspects.

Any city, village or incorporated town may enter into contracts or agreements with the United States that such city, village or town will, with reference to any flood control project constructed or to be constructed by the United States and so located as to furnish protection to the city, village or incorporated town from floods: (1) provide the land necessary for the project; (2) contribute part of the cost of the project; (3) imdemnify the United States from claims for damages arising from such project; (4) maintain and operate all the works after completion of the project; (5) establish and enforce flood channel limits for the protection of any flood channel; (6) prevent dumping of waste material or the creation of fills within any flood channel limits; (7) regulate the construction of bridges crossing any waterway; and (8) restrict further residential development in the area protected. (Heckerling-Fla)
W69-09627

INTERSTATE DRAINAGE DISTRICTS.
Iowa Code Ann secs 467.1 to 467.6 (1949).

Descriptors: *Iowa, *Interstate compacts, *Equitable apportionment, *Drainage districts, Controlled drainage, Governments, State governments, Drainage systems, Cost allocation, Construction costs, Cost sharing, Legislation, Interstate, Boundaries (Property), Administrative agencies, Contracts, Bids, Assessments.
Identifiers: *Interstate drainage districts.

When proceedings for drainage of land bordering the state line are had, and total costs are ascertained, authorities of this state may order a hearing to establish an interstate drainage district upon report of the engineer in charge that such proceedings should be had jointly with an adjoining state. An agreement shall be reached between the states as to equitable allocation of costs among the property owners of each state. Unless construction on each side of the state line can progress independently, no contract shall be let without approval of both states, but the contracts for construction within this state are distinct from contracts of the other state. No contract shall be let until final determination of the improvement and costs. (Harris-Fla)
W69-09628

DRAINAGE DISTRICTS IN CONNECTION WITH UNITED STATES LEVEES.

Iowa Code Ann secs 466.1 to 466.8 (1949).

Descriptors: *Iowa, *Levees, *Cost sharing, *United States, Financing, Navigable waters, Navigable rivers, Construction, Maintenance costs, Drainage districts, Right-of-way, Public health, Drainage systems, Administrative agencies, Construction costs, Assessments legislation, Boundaries (Property).
Identifiers: State boundaries.

Where the United States has built or shall build a levee on a navigable stream forming an Iowa boundary, the county board of supervisors shall have the power to aid in procurring the right of way for and maintaining said levee and providing an internal drainage system to complement the levee construction. Improvements shall be presumed to be conducive to public health. Any United States levee may be considered by the board as a part of the plan for any levee or drainage district and such board may agree with the United States to share in the cost of procurring the right of way and maintenance of such levee. The engineer shall set forth the cost of constructing and maintaining the cooperative levee. If a drainage district is established, all costs incurred under this chapter shall be assessed and collected from lands lying within such district. The annual amount collected for maintenance shall not exceed 12 1/2 mills per dollar of the assessed valuation unless the same is petitioned for in the manner required for the inauguration of new work. (Holt-Fla)
W69-09629

TRUSTEE MANAGEMENT OF DRAINAGE OR LEVEE DISTRICTS.

Iowa Code Ann secs 462.1 to 462.41 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Levees, *Local governments, *Drainage districts, Political aspects, Condemnation, Right-of-way, Eminent domain, Ditches, Drainage, Multiple-purpose projects, Controlled drainage, Legislation, Leases, Settling basins, Mississippi River, Legal aspects, Administrative agencies, Water management (Applied).

Elected trustees are authorized to exercise the power formerly conferred on the boards of supervisors for the control, management, and supervision of drainage and levee districts. The authority of such trustees includes the power to acquire lands by conveyance, lease, or condemnation for rights-of-way for levees, ditches, and settling basins and to annex lands to the district. Specific provisions dictate the manner of election of trustees, the qualifications of trustees, the levee or drainage districts which are entitled to trustee control, how a district can petition for an election of trustees, and how a trustee district can petition to be placed back under the management of a board of supervisors. (Keith-Fla)
W69-09630

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09631

LEVEE AND DRAINAGE DISTRICTS.
Iowa Code Ann, secs 455.45 to 455.51 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Drainage districts, *Levees, Construction, Contracts, Administrative agencies, United States, Damages, Erosion, Railroads, Highways, Benefits, Assessments, Cost allocation, Comparative benefits, Project benefits, Equitable apportionment, Legislation, Local governments, Appraisals.
Identifiers: *Plans, *Improvements.

When a county board of supervisors establishes a levee or drainage district or accepts an improvement or federal plan, such board shall appoint a commission to assess benefits to land within such district. Only present benefits from the present im-

provements or plans are assessed. The benefit assessment from main ditches is reported separately from that of lateral ditches. The commissioners will file a report giving names of and benefits to property owners, railroads, highways, and state lands, the respective assessments for main ditches, lateral levees, and pumping stations, and total assessments. (Darragh-Fla)
W69-09632

DUTY OF ROAD OFFICERS.

Iowa Code Ann sec 319.7 (1949).

Descriptors: *Iowa, *Highways, *Repairing, *Maintenance, Open channels, Ditches, Public rights, Legislation.

All officers responsible for the care of public highways outside cities and towns shall remove all open ditches, water breaks and like obstructions from travelled portions of the highways within their jurisdiction. (Harris-Fla)
W69-09633

BRIDGES OVER STATE BOUNDARY LINE STREAMS.
Iowa Code Ann secs 309.84-309.92 (1949).

Descriptors: *Iowa, *Bridge construction, *Cost sharing, *Interstate rivers, Interstate compacts, Administrative agencies, Cost allocation, Boundaries (Property), Streams, State governments, Cities, Public utilities, Public rights, Taxes, Legislation, Costs, Legal aspects, Local governments.

Bridges on county line roads may by agreement be located, constructed, and maintained by one county to insure a proper site and to avoid unnecessary expense. Work and expense shall be shared by the counties. On petition of 10% of the legal voters of a county bordering a stream which forms a state boundary, an election may be had to determine whether the public favors construction of a foot or wagon bridge across said stream. The question shall be submitted at general election after public notice. If a majority of the voters favor a bridge, the board may agree with an adjoining state, or any municipal division thereof, as to allocation of cost and maintenance. The board may tax property in the county and issue bonds to finance the bridge. Such bridge may be used by public utilities under conditions agreed upon by the constructing and maintaining authorities, but no such use shall interfere with the public use. (Harris-Fla)
W69-09634

CONSTRUCTION AND MAINTENANCE OF BRIDGES AND CULVERTS.
Iowa Code Ann secs 309.67 - 309.83 (1949), as amended, (Supp 1969).

Descriptors: *Bridge construction, *Culverts, *Maintenance, *Iowa, Bridges, Administrative agencies, State governments, Federal government, Construction costs, Cost sharing, Maintenance costs, Repairing, Sluices, Design standards, Structures, Cities, Surface drainage, Bridge design, Cooperation, Legal aspects, Local governments.

The county board of supervisors and the county engineer are responsible for keeping bridges and culverts of the secondary road system open. Boards of supervisors of adjoining counties are required to divide the responsibility and cost of construction and maintenance of bridges and culverts found along county boundary lines. Board plans for the construction of bridges are subject to the approval of the state highway commission. If the intracounty boards fail to adequately cooperate, the state highway commission may render a binding allocation of responsibility. If the intracounty boards fail to comply with the commission's decision, the commission may proceed with the necessary construction or maintenance and bill costs to the respective counties. Similar provisions relate to bridges and culverts located along city-county boundaries. The terms 'culvert' and 'bridge' are defined, and maximum amounts for construction of intracounty and intercounty bridges are set. State specifications must be adhered to in bridge construction. (Keith-Fla)
W69-09635

DRAINAGE OF COAL AND MINERAL LANDS AND MINES.
For primary bibliographic entry see Field 05G.
W69-09636

HYDROELECTRIC GENERATING PLANTS AND PROJECTS.
Iowa Code Ann secs 469A.1 to 469A.7 (1949).

Descriptors: *Iowa, *Hydroelectric project licensing, *Hydroelectric plants, *Public utilities, Facilities, Regulation, Administrative agencies, Control, Water policy, State governments, Investigations, Financial feasibility, Legislation, Legal aspects, Operation and maintenance, Construction.
Identifiers: *Licensing, Penalties (Criminal).

A certificate of convenience and necessity from the executive council of Iowa must be obtained for any person or other entity to engage in the construction, maintenance, or operation of a hydroelectric generating project. Such certificates shall issue only after a public hearing, after the council is satisfied that public convenience will be served, and after the applicant is financially able to complete the project under the council's terms. The council shall regulate hydroelectric projects under this act and may investigate projects and revoke certificates. Violations of this act are misdemeanors, with each day's continued violation constituting a separate offense. (Harris-Fla)
W69-09637

WATER-POWER IMPROVEMENTS.

Iowa Code Ann secs 470.1 to 470.6 (1949).

Descriptors: *Iowa, *Hydroelectric power, *Water utilization, *Facilities, Relative rights, Land tenure, Compensation, Eminent domain, Condemnation, Canals, Highways, Construction, Public rights, Navigation, Legislation, Pipes, Conduits, Financing, State governments, Water works, Public utilities.

Any person or corporation formed to utilize and improve water power in this state, may take and hold real estate, and such products of the land as are necessary for the location and construction of canals, conduits, and other improvements. Compensation shall be made to the owner for such taking. Such person or corporation may alter any road in order that its pipes may pass over, under or along such road, and may also construct pipes over or under any railway, stream or canal, but may not interfere with navigation thereon. Such person or corporation may pass over, occupy and enjoy lands owned by the public, making compensation therefor. In addition, such corporation shall have power to finance and convey as prescribed by this chapter. Within two years of date of acquisition of the powers in this chapter, the person or corporation shall supply capital and actually commence its work, with such water works to be completed within five years. The rights and powers conferred herein shall at all times be subject to legislative control. (Harris-Fla)
W69-09638

ADMINISTRATION - HIGHWAYS - DRAINAGE.
Iowa Code Ann sec 314.7 (Supp 1969).

Descriptors: *Iowa, *Highway effects, *Surface drainage, *Natural flow, Obstruction to flow, Relative rights, Channels, Surface runoff, Legislation, Land tenure, Easements, Public rights, Tile drains.

Officers, employees, and contractors in charge of improvement or maintenance on highways shall not obstruct tile drains and shall not interfere with the natural drainage of surface waters to the injury of adjoining landowners. It is the duty of such persons to drain surface water from the public road in its natural channel. In order to do this, they may enter adjoining lands and remove obstructions to the natural drainage. (Harris-Fla)
W69-09639

FEDERAL WATER RESOURCES PROJECTS.
Iowa Code Ann secs 306.33, 306.34 (Supp 1969).

Descriptors: *Iowa, *Highways, *Easements, *Flooding, United States, State jurisdiction, Federal Government, Administrative agencies, Contracts, Right-of-way, Surface waters, Legislation.
Identifiers: *Federal Water Resources Projects.

The board or commission which has control and jurisdiction over highways affected by federal water resources projects may sell, exchange or convey to the United States a perpetual easement to flood and submerge the highways. Where such easements affect primary roads, state parks or institutional roads, such conveyances shall be in writing and signed as provided by this chapter. Where conveyances are made in connection with secondary roads, they shall also be in writing and signed as provided. (Harris-Fla)
W69-09640

FISH AND GAME CONSERVATION.

Iowa Code Ann secs 109.1-109.13 (1949).

Descriptors: *Iowa, *Fish management, *Regulation, *Administrative agencies, Fish stocking, Lakes, Streams, Legislation, Mussels, Clams, Frogs, Spawning, Fish hatcheries, Fish migration, Overflow, Conservation, Public lands, Water utilization, Fish conservation.

The title to all fish, mussels, clams and frogs in any public waters or waters stocked from overflow therefrom is in the state of Iowa. Title shall remain in the state for purposes of regulating the taking or possession of such aquatic life. The state conservation director is empowered to establish and control the state fish hatcheries for the purpose of stocking the waters of the state. Once the state conservation commission has declared a stream or lake a public park, the conservation director may establish a state game refuge thereon. The commission shall be empowered to regulate game management areas. The director shall have power to set off protected spawning areas. The director must report to the governor all contracts let for the taking of soft fish from state waters. Money derived from such contracts shall inure to the fish and game protection fund. All fish taken unlawfully shall be seized. (Holt-Fla)
W69-09641

FISH AND GAME CONSERVATION.
Iowa Code Ann secs 109.14-109.37 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Fish, *Fish management, *Dams, Dam construction, Fish harvest, Fish reproduction, Fresh-water fish, Frogs, Gastropods, Fish conservation, Wildlife conservation, Administrative agencies, Regulation, Wildlife, Wildlife management, Barriers, Fish barriers, Fish passages, River regulation, Water control, Water levels, Water loss, Pumping plants, Legislation, Legal aspects.
Identifiers: *Dam destruction, Pumping stations, Fishways, Penalties (Criminal).

It is unlawful to obstruct the free passage of fish by the placing of a dam or any other structure in the water unless written permission is obtained from the State Conservation Director. Written permission is likewise required to operate a pumping sta-

tion or plant which is not provided with screens to prevent fish from entering the machinery. It is unlawful to alter a dam in any way so as to lower the water level unless approval is obtained from the Natural Resources Council. The Conservation Director is given authority to remove fish from public waters for certain enumerated purposes provided he does so with minimum injury to the lake or stream. Specific provisions regulate the taking, sale, possession, and transportation of fish and certain other wildlife, and set forth penalties for violation of these provisions. (Keith-Fla)
W69-09642

IMPORTING FISH.

Iowa Code Ann sec 109.47 (1949).

Descriptors: *Iowa, *Fish management, *Fish diseases, Fish control agents, Permits, Regulation, Administrative agencies, Legislation, Legal aspects, Wildlife conservation, Fish pathology, Fish conservation.

Unless a permit is procured from the fish and game commission, it shall be unlawful to place into any inland or boundary waters of Iowa any non-native fish or spawn. Permits will be granted only if such fish are found to be free from disease and beneficial to the native wildlife and people of the state. (Holt-Fla)
W69-09643

INTERSTATE BRIDGES (ADDITIONAL ACT).

Iowa Code Ann secs 383.1 - 383.30 (1949), as amended, (Supp 1969), sec 383.31 (Supp 1969).

Descriptors: *Iowa, *Cities, *Bridges, *Condemnation, Procurement, Administrative costs, Eminent domain, Cost repayment, Leases, Bridge construction, Bridge design, Construction costs, Cost allocation, Contract administration, Maintenance, Interstate rivers, Interstate commissions, Interstate compacts, Public utilities.
Identifiers: *Interstate bridges.

Cities are authorized to acquire by purchase, condemnation, lease, sublease, or otherwise any existing bridge. Any city is further authorized to construct, repair, maintain, reconstruct, enlarge, replace, and operate any such bridge as a toll or free bridge. These powers may be exercised by the city independently or in cooperation with another political unit in or out of the state when such political unit has an interest because the bridge involved is interstate. Bridges so acquired may be conveyed or leased by the city as a public utility. Specific procedures are provided for the acquisition of bridges by purchase or condemnation. The methods of financing by bond issue and taxation are also specifically provided for. Tolls must be charged if necessary for the protection of bondholders. Cities are empowered to create bridge commissions to carry out the foregoing provisions, and the duties and powers of such commissions are enumerated. Such commissions may be jointly created with other political units in appropriate cases. Damage to property or property rights caused by exercise of the foregoing powers is to be reimbursed to the damaged party. (Keith-Fla)
W69-09644

EXERCISE OF EMINENT DOMAIN BY CITIES FOR CONSTRUCTION OF WATERWORKS AND WATER PIPE LINES.

Ark Stat Ann secs 35-902, 35-913, 35-914 (1962).

Descriptors: *Arkansas, *Cities, *Eminent domain, *Water works, Legislation, State governments, Condemnation, Legal aspects, Docks, Levees, Parks, Water pollution, Dams, Lakes, Compensation, Condemnation value, Administrative agencies, Public utilities, Right-of-way, Easements, Construction, Maintenance, Reservoir construction, Dam construction, High water mark, Pipelines, Water supply.
Identifiers: *Water pipelines, Cemetery , Impounding lake.

Cities may exercise the power of eminent domain for the construction of wharves, levees, parks, squares, market places, or other lawful purposes. The term 'or other lawful purposes' is defined to include all or any part of a waterworks system. The power so granted may be exercised out of the county in which the city is located. Specific provision is made for the manner in which a city may condemn cemetery, public utility, county, and state property and for the manner in which these entities are to be compensated or made whole by the condemning city. Property may be condemned for the construction and maintenance of water pipe lines, and the manner in which the city is to proceed in such condemnation is set forth; similar provisions apply to condemnation of property for impounding lakes. (Keith-Fla)
W69-09645

PUBLIC HEALTH AND SAFETY.

For primary bibliographic entry see Field 05G.
W69-09646

HIGHWAYS, BRIDGES AND FERRIES.

SC Code Ann secs 33-812, 33-813, 33-814.1 (1962).

Descriptors: *South Carolina, *Highways, *Drainage, *Right-of-way, Transportation, Road construction, Ditches, Streams, Natural flow doctrine, Pipes, Eminent domain, Surveys, Mapping, Measurement, Access routes, Easements, Real property, Land tenure, Cities, Local governments, Drains, Streamflow, Legislation, Legal aspects.
Identifiers: Overseer.

It shall be a misdemeanor to interfere with a surveyor employed by a county or the line laid out by him. Any county may have the overseer construct footpaths or bridges over streams and along the highways of the county. Any county with a city of more than 86,000 people may accept rights-of-way over and across private property for constructing drainage ditches to drain roads and streets. The direction of flow of natural streams shall not be changed. The grantor of the right-of-way shall furnish all necessary pipes for the drain. The property owner shall give the necessary right-of-way to the final disposition point of the water and shall hold the county harmless for any damage to his land. (Helwig-Fla)
W69-09647

ATLANTIC STATES MARINE FISHERIES COMMISSION.

SC Code Ann sec 28-201 thru 28-205 (1962).

Descriptors: *Fish management, *South Carolina, *Atlantic Ocean, *Interstate compacts, Administrative agencies, Legislation, Regulation, Interstate commissions, Fish conservation, Fishing, Fisheries, Commerical fishing, Sport fishing, Marine fish, Marine fisheries.
Identifiers: *Atlantic States Marine Fisheries Compact.

Pursuant to the Atlantic States Marine Fisheries Compact, three commissioners shall be appointed from this state. The first commissioner shall be the Director of the Division of Commercial Fisheries. The second commissioner shall be a legislator and member of the Commission on Interstate Cooperation designated by that commission. The Governor, with advice and consent of the Senate, shall appoint a citizen with knowledge of the marine fisheries problems as the third commissioner for a term of three years. The commissioners shall have all the powers provided for in the compact and all necessary incidental powers to carry out the compact. All officers of the state shall cooperate with the Commission and furnish it with information and data possessed by them. The Commission shall report on receipts and disbursements annually to the governor and general assembly, set forth the transactions carried on by it, and make recommendations for any action deemed advisable. (Kahle-Fla)
W69-09687

PROTECTION OF FISH (ESTABLISHING FISH HATCHERIES).

SC Code Ann secs 28-693, 28-710, 28-711, 28-712, 28-717, 18-718 (1962).

Descriptors: *South Carolina, *Fish conservation, *Fish hatcheries, *Regulation, Fish, Ponds, Lakes, Rivers, Streams, State governments, Fish management, Condemnation, Eminent domain, Legislation, Legal aspects, Riparian rights, Public rights, Administrative agencies, Water resources development, Cost sharing, Federal project policy, Permits, Financing.
Identifiers: *Fish restoration projects, *Fish sanctuaries.

The owner of a private pond may draw the pond and dispose of the fish by sale at the site in the presence of a Division of Game representative. The state assents to Public Law No. 681, 81st Congress for aid to fish restoration projects. The South Carolina Wildlife Resources Department shall establish such fish restoration projects and fund them from the sale of resident fishing licenses. The South Carolina Wildlife Resources Commission may acquire land by condemnation if necessary to establish fish hatcheries and nurseries. The Commission may also lease or purchase land for the United States Fish and Wildlife Services to establish fish hatcheries. The Director of the Division of Game may designate any place on a river or stream as a fish sanctuary upon approval of the county legislative delegation. The Director may also set apart a lake or pond as a fish sanctuary upon agreement with the landowner. (Breeze-Fla)
W69-09710

WATER POLITICS IN MISSISSIPPI: A COMPARATIVE ANALYSIS OF TWO WATER RESOURCE DEVELOPMENT ORGANIZATIONS,

Mississippi State Univ., State College. Social Science Research Center.
A. R. Jones, and H. M. McLeskey.
Completion Report, Mississippi Water Resources Research Institute, July 1969. 34 p, 2 tab, 2 fig, 6 ref. OWRR Project A-031-MISS.

Descriptors: *Social aspects, *Organizations, Promotion, *Political aspects, Institutions, State governments, Water resources development.

Activities of two large-scale water resource promotional organizations are compared to determine strategies used by each to secure project funding. Activities are analyzed in terms of the history of each organization and its relationships to local publics, the Corps of Engineers, Bureau of the Budget, and Congress. Data were derived from interviews with the Administrators of the two agencies, the Tennessee-Tombigbee Waterway Development Authority (TTWDA), and the Pat Harrison Waterway District (PHWD), and review of organizational records. The findings were: (1) The two organizations are different in purpose and have different images; (2) TTWDA has had to 'sell' its project in view of a marginal economic classification while PHWD's efforts have been supported by relatively high benefit-cost ratios and a comprehensive development plan; (3) TTWDA has created a base of organized support (decentralized representation) in contrast to the centralized pattern of agency representation characteristic of PHWD; (4) In the context of their past histories and current relationships to Congress both organizations are 'successful' in that Congressional authorization and appropriations have, to some degree, been achieved for their respective projects.
W69-09722

STRATEGIC CONSIDERATIONS IN ATTAINING WATER RESOURCES PLANNING GOALS, Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06B.
W69-09771

GAME AND FISH COMMISSION.

Ark Stat Ann secs 47-101 thru 47-134 (1964).

Descriptors: *Arkansas, *Conservation, *Fish conservation, *Administrative agencies, Legislation, State governments, Federal government, Financing, Fish management, Regulation, Permits, Water conservation, Fish harvest, Fish farming.

The control, management, restoration, conservation and regulation of fish is vested in the Arkansas State Game and Fish Commission. The Commission has the exclusive power and authority to issue licenses and permits, provide catch limits, establish fishing zones and seasons, and provide penalties for violations. The Commission shall adopt ways to conserve and propagate fish, and to regulate fish propagation by private individuals. The Commission is authorized to cooperate with agencies of the United States government to further conservation and protection of wildlife. Game wardens and other employees shall be appointed to enforce Commission regulations. The Commission may apply to the state land commission for the use of state lands suitable for fish and game refuges. The fees or funds arising from the Commission activities shall be used to further the conservation goals of the Commission. The state of Arkansas assents to the congressional act designed to aid the states with fish restoration and management. (Darragh-Fla)
W69-09775

FISHING AND HUNTING LICENSES.
Ark Stat Ann secs 47-208 thru 47-210, 47-213, 47-215, 47-217 thru 47-223 (1964), as amended, (Supp 1967).

Descriptors: *Arkansas, *Permits, *Fish management, *Wildlife management, Legislation, Legal aspects, Regulation, Fishing, Fish conservation, Administration, Administrative agencies, Wildlife conservation.
Identifiers: *Penalties (Criminal), *Fishing permits.

A fishing license is required if fish are to be taken by specified methods. Certain classes of persons require special licenses, certain persons are exempt, and certain persons cannot obtain a license. Licenses are of no effect during closed seasons. Criminal penalties are set forth for non-compliance with any of the foregoing provisions. The cost of each type of license is set forth and it is provided that a specified portion of all license fees will go to the Arkansas Game and Fish Commission. Similar provisions apply to the taking of game. (Keith-Fla)
W69-09776

TITLE TO LAND ABOVE THE HIGH WATER MARK.

Ark Stat Ann secs 10-201 thru 10-207 (1956).

Descriptors: *Arkansas, *Alluvium, *Accretion (Legal aspects), *Riparian land, Legislation, Legal aspects, Riparian rights, High water mark, Navigable waters, Non-navigable waters, Beds, Streams, Lakes, Surveys, Boundaries (Property), Ownership of beds, Relative rights, Channels.
Identifiers: *Ownership of alluvium.

The state must institute suits to recover any forgotten, lost, or other outstanding public interest in property or to quiet title to any lands to which the state may claim title. All land which has formed or may hereafter form in the navigable waters of the state and within the original boundaries of a former owner of land along such stream shall belong to such former owner or his successors in interest. Title to all lands which have formed or may hereafter form in the beds of non-navigable lakes or in abandoned river channels or beds, whether or not still navigable, which are above ordinary high-water mark will vest in the riparian owners of said lands. The commissioner of state lands issues deeds to such lands upon application by such riparian owners after a proper survey has been made. (Keith-Fla)
W69-09777

CUTTING TIMBER ON SWAMPS AND OVERFLOWED LANDS.
For primary bibliographic entry see Field 04A.
W69-09778

SALE OF SWAMP AND OVERFLOWED LANDS.
For primary bibliographic entry see Field 04A.
W69-09779

AUTHORITY OF CITIES TO OPERATE HARBORS AND PORTS; CREATION OF PORT AUTHORITIES.
For primary bibliographic entry see Field 04A.
W69-09780

IRRIGATION COMPANIES.
For primary bibliographic entry see Field 03F.
W69-09781

DAMAGE TO WATER, FLOOD CONTROL STRUCTURES, OR FISH.
For primary bibliographic entry see Field 05G.
W69-09782

HIGHWAYS.
For primary bibliographic entry see Field 04A.
W69-09783

INTERSTATE COMPACTS.

Ark Stat Ann secs 76-2101 thru 76-2104 (1958).

Descriptors: *Arkansas, *Interstate compacts, *Interstate commissions, *Bridges, Bridge construction, Legislation, Legal aspects, Mississippi, Mississippi River, Operation and maintenance, Construction, Planning, Eminent domain, Easements, Surveys, Administrative agencies.
Identifiers: Ferries, Property acquisition.

A proposal is made by the state of Arkansas that it enter into an interstate compact with Mississippi for the formation of an Arkansas-Mississippi Bridge Commission. The purpose of such a commission would be the planning, construction, maintenance, and operation of a bridge at a specified location over the Mississippi River. The Commission would have power to: purchase and operate all ferries across the Mississippi River within twenty-five miles of the bridge site; contract; sue and be sued; acquire and dispose of property; and exercise the power of eminent domain. Specifically provided for are the financing of the bridge, rates of tolls, record keeping, and administration of the Commission. (Keith-Fla)
W69-09784

FISHING REGULATIONS.

Ark Stat Ann secs 47-401 thru 47-420 (1964).

Descriptors: *Arkansas, *Fish conservation, *Fishing, Fish management, Legislation, Legal aspects, Size, Baits, Bait traps, Trapping, Bass, Fresh-water fish, Minnows, Regulation, Commercial fishing, Permits.
Identifiers: *Penalties (Criminal).

Specific provisions regulate the manner in which fish may be taken, what baits may be used, and the time, size, and number of fish which may be taken. The licensing of commercial bait dealers is provided for. Criminal penalties are set for violations of each of the foregoing provisions. (Keith-Fla)
W69-09785

MISCELLANEOUS PROVISIONS RELATING TO HUNTING AND FISHING.

Ark Stat Ann secs 47-501 thru 47-524, 47-532 thru 47-534 (1964).

Descriptors: *Arkansas, *Fish conservation, *Commercial fishing, Legislation, Administrative agencies, Fish management, Water levels, Fishing, Sport fish, Dams, Sluices, Regulation, Permits, Fish harvest, Fish passages, Fish guiding, Fish barriers, Water utilization.

All fish not in private ponds are property of the state and the catching of these fish is a privilege. Any violation of regulations pertaining to fishing will subject all equipment used for such catching to seizure. While fish caught outside the state may be brought into the state, certain varieties if caught within the state may not be shipped out of the state without a permit. Commercial fishing is regulated as to size and type of fish. The sale of game fish is prohibited. Any person maintaining a dam across any stream must either keep said stream sufficiently open to allow passage of fish through the dam or construct a sluice over or around the dam. It is unlawful to lower any natural water stage to a point which endangers fish. All intake pipes in waterbodies must be screened to prevent entry of fish. (Darragh-Fla)
W69-09786

MUSSELS.
Ark Stat Ann secs 47-601 thru 47-604 (9164).

Descriptors: *Arkansas, *Mussels, *Shellfish, *Commercial shellfish, Legislation, Aquatic animals, Administrative agencies, Invertebrates, Water conservation, Equipment, Harvesting, Wildlife management, Fishing gear, Permits, Legal aspects, Regulation.
Identifiers: *Mussel harvesting.

Persons licensed under this act may use only one boat in taking mussels for commercial purposes. An additional boat may only be used for towing purposes. The kind and number of tackle to be used in taking mussels for commercial purposes is specified. Size limits are established for the sale, purchase and possession of various mussels or shells and penalties provided for violations. License requirements are set forth for the takers of mussels, the buyers of shells, and for boats used in dealing in fresh-water mussel shells. All holders of a shell buyer's license are required to make an annual report to the state Game and Fish Commission as to the amount, price and source of mussels bought. The state Game and Fish Commission shall enforce the law relating to mussels and may prescribe areas from which mussels may not be taken and the time period of such restriction. For purposes of this act, mussel, crowfoot bar, dredge, commercial purposes and rig are defined. (Marsee-Fla)
W69-09787

CROSSING BY STATE HIGHWAYS OF WATERCOURSES.
For primary bibliographic entry see Field 04A.
W69-09788

RECREATIONAL ACTIVITIES NEAR WATER SUPPLY.
For primary bibliographic entry see Field 05G.
W69-09789

STAUFFACHER V CITY OF SUN PRAIRIE (RIGHTS TO A DRAINAGE EASEMENT).
For primary bibliographic entry see Field 04A.
W69-09790

NORBECK VILLAGE JOINT VENTURE V MONTGOMERY COUNTY COUNCIL (ZONING AS WATERSHED MANAGEMENT).
For primary bibliographic entry see Field 05G.
W69-09791

RIVER FRONT IMPROVEMENT COMMISSION.
For primary bibliographic entry see Field 04A.
W69-09792

CONSTITUTIONAL ISSUES IN GAS AND OIL: AN ANALOGY,
Harvin Pitch.
Agassiz Center for Water Studies Research Report, Vol 1, No 2, 1968. 17 p, 49 ref.

Descriptors: *Foreign countries, *Governments, *Water resources development, *Regulation, Legal aspects, Oil, Natural gas, Legislation, Conservation, Pipelines, Water allocation (Policy), Water pollution, Export, Proration, Political aspects, Marketing, Water utilization, Natural resources, Political constraints, Interstate resources development.
Identifiers: Canada, Federal-provincial conflicts, Constitutional issues.

In Canada the development of oil and natural gas has caused a conflict between dominion and provincial legislation regulating this development. This conflict has raised constitutional issues which would be very similar to those raised if there was a conflict over regulation of water resources development. The common areas of conflict would be regulation of interprovincial trade, regulation for conservation and regulation of the transportation of the natural resources. Under the Canadian constitution provincial legislation controlling price or supply in interprovincial trade is illegal unless the control was incident to a valid provincial interest. Thus provincial legislation concerning conservation of natural resources which indirectly controlled price or supply might be permissible. Legislation preventing 'physical waste' would be a valid state interest, but legislation preventing 'economic waste' would be questioned as unconstitutional. Legislation such as proration of production or export permits which might indirectly affect price or supply would probably stand a better chance of surviving a constitutional challenge if it was for prevention of physical waste rather than economic waste. Also provincial regulation of the transportation facilities for natural resources may raise constitutional questions. If the facilities such as pipelines, motor carriers or pumping stations on natural watercourses were not connected with interprovincial facilities or construction efforts the legislation would stand. (Gadd-Fla)
W69-09793

ASPECTS OF WATER RESOURCES LAW IN MINNESOTA,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Jun 1969, Bulletin 2, p 1-142. 142 p, 258 ref.

Descriptors: *Minnesota, *Water resources development, *Judicial decisions, Legislation, Federal government, State governments, Local governments, Administration, Administrative agencies, Permits, Water rights, Hydrologic aspects, Water allocation (Policy), Water conservation, Water control, Watercourses (Legal), Water demand, Water management (Applied), Water pollution, Water law, Legal aspects.

A compilation of state court decisions includes analyses of decisions regarding: classification of waters; rights in natural surface watercourses; rights in diffused surface waters; rights in natural ground waters; rights in artificial watercourses; prescriptive rights; obstruction and diversion; transfer and assignment of water rights; and water quality. The compilation of state and local statutes presented includes analysis of statutes dealing with: the permit system; mining and the drainage and diversion of water; county and judicial drainage systems; dams and lake water levels, irrigation, pollution control; fish management; topographic and geological surveys; water-borne transportation; water-safety laws; state and federal-state planning; joint control of interstate waters; regulatory programs; water policies of the state; and the numerous administrative bodies responsible for the foregoing. Certain aspects of federal statutes and Supreme Court decisions are analyzed with regard to the role of the federal government and conflicts of federal-state jurisdiction. Conclusions and recommendations are made in light of the foregoing analyses. An appendix contains an unofficial compilation of statutes dealing with water and related land resources passed by the 1969 state legislature. (Keith-Fla)
W69-09794

STATE JUDICIAL CLASSIFICATIONS OF WATER AND STATE JUDICIAL DETERMINATION OF RIGHTS IN NATURAL SURFACE WATERCOURSES,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Jun 1969, Bulletin 2, p 4-22. 18 p, 78 ref.

Descriptors: *Minnesota, *Classification, *Judicial decisions, *Water rights, Legal aspects, Water law, Riparian rights, Natural streams, Reasonable use, Appropriation, Public rights, Surface waters, Subsurface waters, Surface runoff, Confined water, Water utilization, Water users, Priorities, Navigable waters, Ownership of beds, Percolating water.

The state judiciary has set up two systems of water classification. The systems used to determine respective private rights distinguishes between waters on the surface of the earth and waters under the surface of the earth. Water on the surface of the earth is defined to include diffused surface waters, natural watercourses, natural bodies of water, and artificial surface watercourses. Water under the surface of the earth is defined to include underground waters in definite streams, underground percolating waters, and artesian waters. Each subclassification is defined. The system used to resolve private-public use conflicts distinguishes between public and private waters; private water is defined as diffused surface water and public water includes all of the other foregoing subclassifications. By way of contrast, hydrologic classifications are discussed. The state judiciary has adopted part of the appropriation doctrine and part of the riparian doctrine for use in determination of rights in natural surface watercourses. Cases dealing with the following are analyzed in light of these two doctrines: reasonable use theory; users of water; priorities as to competing uses; navigable waters; ownership of watercourses, beds and overlying waters; and legal differences with respect to streams, lakes, ponds, and watercourses. (Keith-Fla)
W69-09795

STATE JUDICIAL DETERMINATION OF RIGHTS RELATIVE TO DIFFUSED SURFACE WATERS, NATURAL GROUND WATERS, ARTIFICIAL WATERCOURSES, AND OTHER COMMON LAW PRINCIPLES,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Bulletin 2, Jun 1969, p 22-37. 15 p, 68 ref.

Descriptors: *Minnesota, *Judicial decisions, *Reasonable use, *Relative rights, Surface runoff, Repulsion (Legal aspects), Cities, Remedies, Artificial watercourses, Prescriptive rights, Obstruction to flow, Diversion, Riparian rights, Legislation, Water permits, Water pollution, Water rights, Water law, Legal aspects, Water users, Alteration of flow.

The state courts first used the common enemy doctrine in deciding disputes regarding diffused surface water. The courts now use the reasonable use doctrine in deciding such disputes and have laid down guidelines for its application. The state courts have rejected the absolute ownership rule and correlative rights doctrine in determining relative rights to natural ground waters; the reasonable use doctrine is used instead. Although no state court has decided a case involving relative rights in artificial watercourses, the courts' tendency to treat artificial watercourses substantially the same as natural ones indicates that the courts will apply the reasonable use doctrine to artificial watercourses. The circumstances under which the courts have held for prescriptive rights with respect to riparian owners on altered natural watercourses and owners of land on which diffused surface waters are discharged are set forth. The circumstances under which obstruction and diversion are permitted and prohibited by the courts are discussed. The courts have ruled that riparian rights may be assigned to non-riparian owners, but it is noted that the statutory permit system has largely abrogated such rulings. Remedies for private and public pollution are discussed. (Keith-Fla)
W69-09796

ASPECTS OF STATE STATUTES I,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Jun 1969, Bulletin, p 39-51. 12 p, 34 ref.

Descriptors: *Minnesota, *Legislation, *Water conservation, *Water resources development, Water law, Judicial decisions, Administrative agencies, Water permits, Water allocation (Policy), Mining, Drainage, Diversion, Construction, Maintenance, Dams, Drainage districts, Pollution, Irrigation programs, Legal aspects, Regulation, Water pollution control, Drainage systems, Water levels, Programs.

A compilation of state statutes dealing with water law is presented. Each statute is accompanied by a discussion of how it does or may affect the corresponding common law dealing with water law. General charge and control over the waters of the state and of their disposition is given to the Commissioner of Conservation. He is given the power to devise and develop a general water resources conservation program for the state, which program shall contemplate the conservation, allocation, and development of all the waters of the state for the best interests of the people. The state permit system in theory adopts an appropriation concept, but in practice relies heavily on common law concepts to regulate waters. A water resources board is authorized in order to provide a forum for resolution of conflicting public interests. Permits for drainage, diversion, control, or use of water can be granted when necessary for mining. County boards and district courts are authorized to construct and maintain public drainage systems. Dams and lake water levels are specifically regulated. Drainage, conservancy, and watershed districts are authorized, and their powers and responsibilities are enumerated. Irrigation is regulated. Pollution is heavily regulated and several agencies police its regulation. (Keith-Fla)
W69-09797

ASPECTS OF STATE STATUTES II,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Jun 1969, Bulletin 2, p 51-77. 26 p, 23 ref.

Descriptors: *Minnesota, *Legislation, *Water resources development, *Administrative agencies, Geological surveys, Soil conservation, Legal aspects, Structures, Harbors, Port authorities, Planning, Multiple-purpose projects, Coordination, Great Lakes, Treaties, Water policy, Regulation, Project planning.

The powers of the State Board of Health with regard to the enforcing of specified water law statutes are enumerated. Topographic and geological surveys are authorized. The powers of soil conservation districts and the Game and Fish Commission relative to water law are listed. Water-borne transportation and facilities therefore are provided for and regulated. County sheriffs are charged with the responsibility of enforcing water safety laws. Numerous administrative agencies are charged with the coordination, planning, and carrying out of varied water-related programs. The compacts, agreements, and treaties resulting from the state bordering on the Great Lakes are all noted briefly. The policies of the state with regard to water and water-related problems are enumerated as abstracted from policy declarations and the state laws. Provision is made for mandatory coordination and cooperation of all agencies and other organizations dealing with water and related land resources. (Keith-Fla)
W69-09798

ASPECTS OF FEDERAL STATUTES AND SUPREME COURT DECISIONS,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Jun 1969, Bulletin 2, p 79-96. 17 p, 47 ref.

Descriptors: *Minnesota, *Federal government, *Legislation, *Judicial decisions, Water law, Legal aspects, Administrative agencies, Flood control, Water resources development, Multiple-purpose projects, Recreation, Water pollution, Federal jurisdiction, Federal-state water rights conflicts, State jurisdiction, Federal project policy.
Identifiers: *Federal policy, Constitutional authority.

A discussion of the federal government's impact on the field of water law begins with a consideration of the constitutional authority for federal participation and their historical entry into the field. An analysis of the role of federal government includes discussions of federal cases and statutes, defines the jurisdiction of the federal government, and makes the point that federal regulations control over state law in case of conflict. Separate discussions explore the expanding role of the federal government in the areas of flood control, water resources development, multiple-purpose water resource development projects, water pollution, and recreational use of water. Two discussions center around criticisms aimed at the federal government: its forcing of the states to bypass their existing governmental units because of federal financial incentives, and its failure to require integration of efforts under a comprehensive plan covering all involved governmental units and agencies. A discussion of conflicts of federal-state jurisdiction begins by pointing out that by looking at 'jurisdiction' in the sense of 'power to act', the federal government is shown to have almost unlimited jurisdiction over water. While the need for a national water resources policy is conceded, methods for resolving conflicts are proposed. (Keith-Fla)
W69-09799

CONCLUSIONS AND RECOMMENDATIONS,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Raymond A. Haik, William C. Walton, and David L. Hills.
Aspects of Water Resources Law in Minnesota, Jun 1969, Bulletin 2, p 97-105. 8 p.

Descriptors: *Minnesota, *Water resources development, *Water law, *Administrative agencies, Federal government, Legislation, Judicial decisions, Coordination, Irrigation, Irrigation permits, Hydrologic data, Water permits, Diversion, Water transfer, Watershed management, Water rights, Legal aspects, Classification, Flood control.
Identifiers: *Federal policy, *State policy, Cooperation.

To increase the working efficiency of the numerous organizations participating in water resources activities carried on within the state, responsibility for comprehensive coordination and cooperation should be centralized; efforts to achieve this goal have thus far proved unfruitful. The state's combined common law and statutory scheme for determination of relative rights with respect to water use is well adapted t o the needs of the state. The state's irrigation policy should be based on hydrologic conditions. The water permit system should allow for controlled transfers and diversions of water from one watershed to another. The permit system needs modification to reduce the uncertainty of water rights, and to provide definite criteria for permit granting. The present legal classification of water should be replaced by hydrologic classifications. The state should take greater responsibility in the area of flood control. Congress should curtail the extent to which the federal government exercises its powers in the area of water resources and should give states and localities a stronger voice in federal programs. (Keith-Fla)
W69-09800

STATE V MANNING (ACTION FOR TRESPASS ON A LAKE).

165 SE 2d 13-15 (NC Ct App 1969).

Descriptors: *North Carolina, *Lakes, *Recreation, *Leases, Judicial decisions, Legal aspects, Fishing, Hunting, Dams, Ponds, Waterflow, Riparian land, Riparian waters, Recreation facilities, Water resources development, Riparian rights, Land tenure.
Identifiers: Trespass, Penalties (Criminal).

The defendants were charged with trespassing on a lake which was posted with 'no trespassing' signs. The lake had been developed by a corporation formed to build a dam to create the lake. The corporation was a private club whose members had fishing privileges in the lake. The club leased all the property surrounding the lake, including the lake itself. The defendants were arrested pursuant to a request by the club president. The court stated that it was irrelevant whether the lake was a 'private pond' because that factor had no bearing on the trespass statute. The court held that the trespass statute would only authorize arrests incident to the consent of the owners. The court further stated that a lessee is not an owner under the law, and therefore the club could not supply the necessary consent for the arrest of the defendants. The court granted the defendants' motion for a nonsuit. (Shevin-Fla)
W69-09801

ZABEL V TABB (PERMIT TO DREDGE AND FILL IN NAVIGABLE WATERS).
For primary bibliographic entry see Field 04A.
W69-09802

POISONING OR CONTAMINATING WATER.
For primary bibliographic entry see Field 05G.
W69-09803

WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
W69-09804

DUTIES AND POWERS OF STATE HIGHWAY DEPARTMENT.
For primary bibliographic entry see Field 04A.
W69-09805

WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
W69-09806

WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
W69-09807

WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
W69-09808

WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
W69-09809

MERRIMACK RIVER FLOOD CONTROL COMPACT.
For primary bibliographic entry see Field 06F.
W69-09810

CONNECTICUT RIVER FLOOD CONTROL COMPACT.
For primary bibliographic entry see Field 06F.
W69-09811

PUBLIC HEALTH (DRAINAGE, PUBLIC POOLS AND BATHING PLACES).
For primary bibliographic entry see Field 05G.
W69-09812

DRAINAGE OF LAND ADJACENT PUBLIC ROADS.
For primary bibliographic entry see Field 04A.
W69-09813

COASTAL FISHERIES LAWS (FISH AND GAME).

SC Code Ann secs 28-770 thru 28-991 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Commercial fishing, *Fish, *Fish conservation, Commercial fish, Legislation, Regulation, Shellfish, Commercial shellfish, Oysters, Shrimp, Crabs, Clams, Fish management, Fisheries, Fish handling facilities, Saline water fish, Ownership of beds, Beds under water, Leases.
Identifiers: *Bed limits and dimension.

South Carolina may regulate coastal fishing within the territorial jurisdiction of the waters of the state. Special regulations apply to oyster, shrimp, crab, and clam cultivation, harvest, and processing. Certain geographical areas are delineated in which shrimp trawling will be allowed, depending on the season. Regulations are specified concerning the taking of blue crabs, including the geographical areas and seasons for harvest. The geographical areas and seasons during which shad and sturgeon may be taken are delineated. Portions of bottom land owned by the state may be leased for the purpose of commercial oyster culture, not to exceed one thousand acres to any one person for longer than five years. Regulatory provisions for non-food fish and for the use and construction of seines and nets in general as well as penalties, licensing, and taxing provisions applicable to all fish gathered from state waters are provided. Included in these provisions are shrimp and crab boat licenses, pealers and processors licenses, non-food fish fishing licenses, wholesaler and power boat licenses, and shipping certificate provisions. (Moulder-Fla)
W69-09814

FISH PROTECTIVE REGULATIONS.

Ill Ann Stat ch 56, secs 160-161 (Smith-Hurd 1967), as amended, (Supp 1969).

Descriptors: *Illinois, *Wildlife conservation, *Fish management, *Fish, Turtles, Crayfish, Mussels, Sewage, Water pollution, Damages, Ice, Water, Aquatic life, Fishing, Fish conservation, Legislation, Legal aspects, Water law, Regulation, Water pollution control, Seasonal.

The state has title to all fish, frogs, turtles and crayfish within the jurisdiction of the state and none of the same may be taken in any manner except as provided by law. Any person who causes waste or sewage to be discharged into the waters of the state so as to kill aquatic life is liable in damages to the state. Persons may not deposit rubbish, trash or other insoluble materials into the waters or upon the ice of any waters of the state. Protected forms of aquatic life include a number of varieties of fish, certain turtles, certain frogs and mussels, none of which may be taken by devices defined as illegal by this act. Seasons are established when certain fish may be taken. (Johnson-Fla)
W69-09815

PORTS AND MARITIME MATTERS.
For primary bibliographic entry see Field 04A.
W69-09816

CITY OF COON RAPIDS V SUBURBAN ENGINEERING INC. (FAILURE TO MEET SPECIFICATIONS FOR A DRAINAGE SYSTEM).
For primary bibliographic entry see Field 04A.
W69-09817

EXTENSION OF BOULEVARD OVER PUBLIC WATER WAYS.
For primary bibliographic entry see Field 04A.
W69-09818

NAVIGATION AND WATERS (VESSELS).
For primary bibliographic entry see Field 04A.
W69-09819

RIVERS AND STREAMS (GENERAL PROVISIONS).
For primary bibliographic entry see Field 04A.
W69-09820

NAVIGATION AND WATERS.
For primary bibliographic entry see Field 04A.
W69-09821

SANITARY WATER BOARD.
For primary bibliographic entry see Field 05G.
W69-09822

FLOOD CONTROL.
For primary bibliographic entry see Field 04A.
W69-09823

ACQUISITION OF UTILITIES AND RECLAMATION OF PREVIOUSLY SUBMERGED LAND BY CITIES.
For primary bibliographic entry see Field 04A.
W69-09824

WATER SUPPLY, DRAINAGE FLOOD CONTROL.
For primary bibliographic entry see Field 04A.
W69-09825

INDIVIDUAL DRAINAGE RIGHTS.
For primary bibliographic entry see Field 04A.
W69-09826

DRAINAGE AND LEVEE DISTRICTS WITH PUMPING STATIONS.
For primary bibliographic entry see Field 04A.
W69-09827

IOWA NATURAL RESOURCES COUNCIL.
For primary bibliographic entry see Field 06B.
W69-09828

FEDERAL FLOOD CONTROL COORDINATION.
For primary bibliographic entry see Field 04A.
W69-09829

BRIDGES OVER NAVIGABLE RIVERS.
For primary bibliographic entry see Field 04A.
W69-09830

DEPARTMENT ACQUISITION AND OPERATION OF CERTAIN FERRIES.
Ill Ann Stat ch 121, secs 10-901, 10-902 (Smith-Hurd 1960).

Descriptors: *Illinois, *Rivers, *Condemnation, *Operation and maintenance, Legislation, Boats, Facilities, Highways, State governments, Census, Maintenance, Operations, Transportation, Regulation, Administrative agencies.
Identifiers: *Ferries, *Illinois River, Counties, Ferry landings.

The highway department may purchase or condemn the franchise and all equipment, boats, landing facilities, and other appurtenances of any ferry in existence on March 15, 1959, operating on the Illinois River and connecting any road from a county having not more than 7000 inhabitants, with any state highway in a county of not more than 16,000 inhabitants. The department may operate any ferry service for the conveyance of persons across the Illinois River so long as such operation is justified by the amount of traffic using such ferry. The location of the ferry landings and the route of the ferry shall be determined by the department. (Shevin-Fla)
W69-09831

COUNTY TOLL BRIDGES.

Ill Ann Stat ch 121, secs 10-301, 10-302 (Smith-Hurd 1960).

Descriptors: *Illinois, *Bridges, *Local governments, *Operation and maintenance, Legislation, Navigable waters, Non-navigable waters, Legal aspects, Bridge construction, Eminent domain, Repairing, Boundaries (Property).

Each county of this state is authorized to acquire, construct, repair, maintain and operate bridges over and across any navigable or non-navigable stream within such county, or forming a boundary line between such county and any other county in this state, or forming a boundary line between the state of Illinois and any adjoining state. Every county which exercises its powers under this article shall have the right of eminent domain. (Heckerling-Fla)
W69-09832

DIVISION OF COMMERCIAL FISHERIES.
SC Code Ann secs 28-159 thru 28-180 (1962), as amended, (Supp 1968).

Descriptors: *South Carolina, *Marine fisheries, *Fish management, *Commercial fishing, Commercial shellfish, Commercial fish, Administrative agencies, Legislation, Regulation, State jurisdiction, Atlantic Ocean, Saline water, Fishing, Marine fish, Fish conservation, Permits, Taxes, Administration, Legal aspects.
Identifiers: Law enforcement, Licenses, Penalties (Civil).

The Division of Commercial Fisheries shall have jurisdiction over all saltwater fishing and all fisheries in the state whereupon a tax or license is levied for commercial purposes. The Division may expend up to $100 per annum in the experimental propagation of shellfish. Six launches shall be purchased and maintained by the Division as a police fleet. Inspectors appointed by the Division may wear uniforms and badges and shall have the power to enter vessels and any premises and to arrest for violations of the Coastal Fisheries Laws. The Division may adopt rules and regulations for the control of fisheries not contrary to state law and provide penalties for their violation. Records shall be kept of: leases granted for bottoms used in shellfish propagation; the amounts of all permits issued; the commercial value of all fish taken in the state; and the number and earnings of men engaged in t he fishing industries. The Division may prosecute for the collection of revenue due from fishing industries and employ counsel with special knowledge of fisheries laws to that end. (Kahle-Fla)
W69-09833

MISSISSIPPI BRIDGES PURCHASED.
For primary bibliographic entry see Field 04A.
W69-09834

DRAINAGE.
For primary bibliographic entry see Field 04A.
W69-09835

OHIO RIVER VALLEY WATER SANITATION.
For primary bibliographic entry see Field 05G.
W69-09836

CHANGES IN ROADS, STREAMS, OR DRY RUNS.
For primary bibliographic entry see Field 04C.
W69-09837

SOIL CONSERVATION.
For primary bibliographic entry see Field 04D.
W69-09838

WATER NAVIGATION REGULATIONS.
For primary bibliographic entry see Field 04A.
W69-09839

STATE CONSERVATION COMMISSION.

Iowa Code Ann secs 107.28-107.34 (Supp 1969).

Descriptors: *Iowa, *Conservation, *Recreation facilities, *Watershed management, Legislation, Administrative agencies, Federal government, Project planning, Fish conservation, Financing, Project purposes, Public benefits, Recreation, Watersheds (Basins).
Identifiers: *Conservation commission.

The state conservation commission is hereby authorized to perform such acts as may be necessary to the conduct and establishment of cooperative fish restoration projects in compliance with federal acts and regulations. The commission is also authorized to perform such acts as may be necessary to conduct and establish cooperative outdoor recreational and watershed facilities as may be defined by the Congress of the United States and may accept federal funds for such projects. The state and its subdivisions should enjoy the benefits of federal assistance programs for the planning and development of outdoor recreation resources. The commission is authorized to prepare, maintain, and keep up-to-date a comprehensive plan for the development of the outdoor recreation resources of the state and to acquire lands, waters, and interests in lands and waters for such areas. The commission may apply for funds from any appropriate federal agency. (Heckerling-Fla)
W69-09840

FISH AND GAME CONSERVATION.

Iowa Ann Code secs 109.99-109.101, 109.105 (1949), as amended, (Supp 1969).

Descriptors: *Iowa, *Mussels, *Regulation, Legislation, Mississippi River, Missouri River, Administrative agencies, Baits, Bait fishing, Administration, Shellfish, Fish management, Fish harvest, Permits.
Identifiers: Des Moines River.

It is unlawful to take, catch, or kill mussels for commercial purposes without first procurring a mussel license. Mussels may be taken from the Mississippi and Missouri rivers at any time and may be taken from designated portions of the Red Cedar, Iowa, and Des Moines rivers between June 15 and November 30, of each year. All other state waters are closed. Manufacturers of pearl buttons or fish bait may possess mussels lawfully taken, and a licensed fisherman may take mussels to be used by him for bait or food. All holders of mussel licenses must report before April 1 of each year to the Fish and Game Commission the weight of his catch, where they were taken, and the amount received for the shells. (Holt-Fla)
W69-09841

COMMERCIAL FISHING.

Iowa Code Ann secs 109.106-109.120 (1949), as amended, (Supp 1969), sec 109.121 (Supp 1969).

Descriptors: *Iowa, *Fish conservation, *Commercial fishing, *Fishing gear, Catfishes, Mississippi River, Missouri River, Regulation, Nets, Tributaries, Legislation, Water policy, Minnows, Administrative agencies, Administration.

Except for taking minnows or as otherwise provided, it is unlawful to take fish by seines or other devices. The use of seines and other devices for catching fish is restricted in tributaries emptying into the Mississippi. All seines and other devices for taking fish must be properly licensed. Fish salesmen may not possess catfish under 13 inches. The size of mesh or seines and the sizes of other fish-taking devices are controlled. Enumerated fish-taking devices may be used in the Mississippi and Missouri rivers, and designated fish may be taken therefrom. Certain fish species that meet minimum weight or length requirements may be taken from the Mississippi and Missouri rivers. Commercial fishermen may retail or wholesale their catches but all other salesmen must procure a license. Commercially licensed fishermen must annually report to the fish and game commission the amount of their catch and where and how their catch was taken. It is unlawful to market fish without first procuring a license. Records of the species and quantities of all fish taken from Iowa waters and handled by the licensee must be kept for each license year. Punishments are provided for violating the above provisions. (Holt-Fla)
W69-09842

BENEFITED WATER DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09843

WATER AND AIR POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09844

WATER AND AIR POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09845

SOUTH CAROLINA WILDLIFE RESOURCES DEPARTMENT.
SC Code Ann secs 28-93, 28-97, 28-100, 28-101, 28-104, 28-106, 28-107, 28-108 (1962), as amended (Supp 1968).

Descriptors: *South Carolina, *Wildlife conservation, *Commercial fishing, *Hunting, Sport fishing, Regulation, Administrative agencies, Legislation, Adjudication procedure, Permits, Taxes, Fish conservation, Shellfish, Commercial shellfish, Shrimp, Fish management.
Identifiers: Law enforcement.

The Wildlife Resources Commission is established as a branch of the Wildlife Resources Department. All functions of the commission shall be performed by the Division of Game and the Division of Commercial Fisheries. The Division of Game shall function to conserve game and enforce tax and license laws relating to game and private fishing. The Division of Commercial Fisheries shall embrace the conservation of shellfish and commercial fishing and the execution of license and tax laws pertaining thereto; provided that the enforcement of such laws shall be performed by the Division of Game. The Division of Commercial Fisheries shall consist of a director, skilled in the conservation of commercial fishing resources, and such employees as may be necessary. The commission shall hold bearings in all matters relating to shellfish, shrimp, and commercial fishing. Appeals may be taken to the courts in all matters as were formerly appealable from the State Board of Fisheries. Authorized agents of the Wildlife Resources Department may conduct scientific investigations at the request of the directors of the Divisions of Game and Commercial Fisheries. The department may acquire land for the purpose of maintaining game and fish preserves. The commission shall have charge of state game wardens and supervise enforcement of state laws pertaining to game and fisheries. (Kahle-Fla)
W69-09846

UNLAWFUL TO SWIM IN CERTAIN AREA.

SC Code Ann, sec 51-240 (1962).

Descriptors: *South Carolina, *Swimming, *Boat-launching ramp, *Regulation, Competing uses, Legislation, Legal aspects, Recreation, Water sports, Recreation facilities, Water policy, Public rights, Boating.
Identifiers: Penalties (Civil).

Swimming between the boat landing at Brighton Beach and the dock of J. E. Smith is unlawful. Violations of this provision are punishable by a fine not more than $100 and imprisonment not more than 30 days. (Breeze-Fla)
W69-09847

STATE BOARD OF HEALTH; SHELLFISH.

17 SC Code Ann 250-253 (1962).

Descriptors: *South Carolina, *Commercial shellfish, *Environmental sanitation, *Permits, Interstate, Administrative agencies, Regulation, Legislation, Public health, State governments, Surveys, Inspection.
Identifiers: *Public Health Service, Packing, Shucking, Records.

Any person, firm, corporation or association shucking, packing or selling shellfish must first obtain and display a permit from the State Board of Health. In order to provide sanitary control of the shellfish industry, the state, industry, and the Public Health Service shall be responsible for certain procedures. The state shall regulate the industry and the regulatory authority shall inspect, survey and condemn growing areas and patrol restricted areas. The authority shall inspect plants, issue certificates to producers and dealers and supply records to the Public Health Service. The certificate holders shall place their certificate number on all packages of shellfish shipped in interstate commerce and keep records which may be inspected by the regulatory authority and the Health Service. The Health Service shall inspect and rate plants in each state and keep a list of authorized interstate shippers and publish the list for the use of consumer states. Statutory definitions given shall apply in the interpretation of the rules and regulations set forth for control of the industry. (Harris-Fla)
W69-09848

CHICAGO PARK DISTRICT: ACQUISITION OF RIPARIAN RIGHTS AND HARBOR DEVELOPMENT.

Ill Ann Stat ch 105, secs 333.15, 333.20, 333.23m thru 333.23u (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Parks, *Harbors, *Water resources development, Administrative agencies, Condemnation, Riparian rights, Bonding, Legislation, Leases, Taxes, Recreation facilities, Recreation, Operation and maintenance, Public benefits, Project planning, Cities, Land tenure, Ownership of beds, Beds under water, Cost repayment, Legal aspects, Financing, Regulation, Real property.
Identifiers: Chicago Park District.

The Chicago Park District shall have the power to acquire any and all real estate, riparian estates or rights, and other property needed for developing a park and for improving wharfs, piers, jetties, and shore protection works associated with such parks. The District may issue bonds for payment of land so acquired and for the other improvements made. The District may maintain a harbor for recreational use and benefit of the public and the district shall have certain enumerated rights and powers over such harbor. Any right or interest of the state in submerged lands within the harbor shall be vested in the District. The District shall have the power to borrow on the anticipated revenue of the harbor and set up ordinances for the acquisition of the harbor. (Heckerling-Fla)
W69-09849

UNIFORM STATE LAW FOR AERONAUTICS.

SC Code Ann secs 2-2, 2-4 thru 2-6 (1962).

Descriptors: *South Carolina, *Aircraft, *Navigation, *Competing uses, Regulation, Damages, Legislation, Legal aspects, Hydrofoils, Transportation, Water rights, Public rights, Preferences (Water rights), Boundaries (Property), Priorities, Boundaries (Surfaces), Land tenure, Relative rights.

'Aircraft' means any vehicle used for navigation through the air including a hydroplane. A hydroplane is governed by water navigation rules while at rest on the water or while operated on or immediately above the water. It is treated as an aircraft while operated in the air other than immediately above the water. Flight over land and water is lawful as long as it does not interfere with existing uses or become imminently dangerous. (Breeze-Fla)
W69-09850

VAN DUYSE V FLEMING (NATURAL DRAINAGE OVER ADJACENT LAND).
For primary bibliographic entry see Field 04A.
W69-09851

SOLOMON V CONGLETON (RIGHT TO OBSTRUCT NATURAL WATERCOURSES AND SURFACE DRAINAGE).
For primary bibliographic entry see Field 04A.
W69-09852

STEWART V STEPHENS (WATERCRAFT OPERATION).
166 SE 2d 890-893 (Ga 1969).

Descriptors: *Georgia, *Boating, *Swimming, *Water sports, Boats, Lakes, Recreation, Administrative agencies, Administrative decisions, Judicial decisions, Legal aspects, Regulation.
Identifiers: Family purpose doctrine, Watercraft.

While swimming in a Georgia lake, a 16 year old boy was run into and cut to death by a boat owned by defendant and operated by his 13 year old daughter. The boat was kept by defendant for the comfort, pleasure and convenience of his family. The mother of the decedent brought a wrongful

death action alleging application of the family purpose doctrine and violation of a regulation promulgated by the State Game and Fish Commission stating that the owner of a watercraft shall be liable for any injury or damage occasioned by the negligent operation of such watercraft. The lower court held the family purpose doctrine not applicable to boats but gave judgment for plaintiff. On appeal by defendant the appellate court reversed. On certiorari, the Georgia Supreme Court held that the family purpose doctrine is applicable to boats. The court held further that the Game and Fish Commission exceeded its delegated authority in adopting a rule of civil liability between private citizens in that the legislature did not authorize the commission to adopt a rule rendering liable the owner of watercraft for their negligent operation. (Carruthers-Fla)
W69-09853

PORTSMOUTH-KITTERY BRIDGE.

NH Rev Stat Ann secs 258:1 thru 258:16 (1964).

Descriptors: *New Hampshire, *Interstate compacts, *Bridges, *Administrative agencies, Water law, Legislation, Legal aspects, Jurisdiction, Administration, Financing, Government finance, Local governments, Federal government, State governments, Bridge construction, Interstate commissions, Political aspects, Cooperatives, Coordination, Planning costs, Cost allocation, Projects, Project planning, Highways, Bonding.
Identifiers: Interstate bridges, Toll bridges.

New Hampshire and Maine agree to build a bridge between the towns of Portsmouth and Kittery by establishing 'The Maine-New Hampshire Interstate Bridge Authority' which has full authority over coordination of matters relating to construction of such bridge. The authority is incorporated within the state of New Hampshire with full corporate powers which are enumerated at length. The authority may also issue bonds to finance such construction. Specific provisions are set forth for the payment of these bonds and for the protection of the bondholders. (Johnson-Fla)
W69-09854

PORTSMOUTH-KITTERY BRIDGE COMPACT.

NH Rev Stat Ann sec 258:1 (1964).

Descriptors: *New Hampshire, *Interstate compacts, *Bridges, *Administrative agencies, Administration, Legislation, Water law, Legal aspects, Political aspects, Bridge construction, Real property, Right-of-way, Financing, Regulation, State governments, Governments, Maine, Interstate commissions, Operation and maintenance.
Identifiers: Toll bridges.

Because the existing bridge was inadequate for either highway or rail traffic and because upstream commerce on the Piscataqua River was hampered by the narrow drawspan on the old bridge, New Hampshire and Maine entered into a compact to cooperate in the building of a new bridge between Portsmouth and Kittery which would be adequate to serve the needs of both land and water borne commerce. The compact creates the Maine-New Hampshire Interstate Bridge Authority, the sole purpose of which is to supervise and coordinate the construction of said bridge. The Authority has the power and authority to sue and be sued, construct, maintain and operate an interstate toll bridge between the points previously indicated, acquire such real property as necessary for same, charge and collect fees, enter contracts, and other powers necessary to the fulfillment of its function. A number of other administrative details may be found in the compact dealing with such things as the ability to make rules and to incur obligations for salaries as well as regulation of the business affairs of the Authority. (Johnson-Fla)
W69-09855

PORTSMOUTH-KITTERY BRIDGE.

NH Rev Stat Ann secs 258:2 thru 258:7 (1964).

Descriptors: *New Hampshire, *Interstate compacts, *Bridge construction, *Financing, Bridges, Administration, Legislation, Legal aspects, Water law, Federal government, State governments, Project planning, Costs, Local governments, Cost repayment, Political aspects, Bonding, Operation and maintenance.

The compact provides that the governor of New Hampshire shall appoint three residents of the state to be members of 'The Maine-New Hampshire Interstate Bridge Authority.' Such members then have to submit the compact for approval to the Congress of the United States. The Authority is incorporated under the laws of New Hampshire and has the powers necessary for the construction, operation, and maintenance of an interstate toll bridge between Portsmouth and Kittery. The Authority has power to issue negotiable bonds for the purpose of paying the costs of the bridge and its highway approaches, but such bonds do not constitute a debt of the state or any agency or political subdivision thereof. (Johnson-Fla)
W69-09856

SACHS V CHIAT (DAMAGE FROM SURFACE WATER RUNOFF).
For primary bibliographic entry see Field 04A.
W69-09857

HENSON V GERLOFS (LANDFILLS UPON PUBLIC EASEMENT).
13 Mich App 435, 164 NW 2d 533-539 (1968).

Descriptors: *Michigan, *Riparian rights, *Easements, *Landfills, Earthworks, Land forming, Lakes, Navigable waters, Bodies of water, Streams, Public land, Recreation, Boating, Riparian land, Legal aspects, Prescriptive rights, Water rights, Judicial decisions, Access routes, High water mark.
Identifiers: Prescriptive easements, Injunctions (Mandatory).

Plaintiffs were owners of land located on two navigable lakes which were connected by a stream. Defendants intended to improve by filling the property lying between the two lakes for commercial recreational purposes. The public had a right of ingress and egress by a prescriptive easement over the filled land to the lakes. Plaintiffs, as riparian owners and as members of the public sought a mandatory injunction against continued filling and an order to remove a portion of the fill. The trial court granted the relief and defendants appealed. The court found that evidence of both parties as to the area covered by the public easement coincided and held that the injunction issued covered more than this area. The injunction should have been limited to the areas over which the easements existed. The court also found that portions of the fill were on dryland above the ordinary highwater mark and did not interfere with the rights of riparian owners or the general public but provided better access to the lake and connecting stream. Defendants therefore did not have to remove this portion of the fill. (Helwig-Fla)
W69-09858

STATE BOUNDARIES.

NH Rev Stat Ann secs 1:1, 1:4 (1955).

Descriptors: *New Hampshire, *Boundaries (Property), *Alteration of flow, *Structures, Boundaries (Surfaces), Interstate, Vermont, Obstruction to flow, Flow augmentation, Dams, Banks, Beds, Flow, Permits, Legal aspects.
Identifiers: *Connecticut River, Penalties (Civil).

No alteration of the banks or bed of the Connecticut River, erection of any structure thereupon, or any other operation affecting the flow of the river, so as to make difficult the ascertaining of the boundary line between New Hampshire and Vermont, shall be commenced without first giving notice to the attorneys-general of each state. Failure to give such notice is punishable by fine not to exceed $5000. (Kahle-Fla)
W69-09859

COLLECTING SEAWEED.

NH Rev Stat Ann secs 572:28-572:34 (1955).

Descriptors: *New Hampshire, *Marine plants, *Aquatic life, *Aquatic plants, Plants, Planting management, Seashores, Sea water, High water mark, Salt marshes, Shallow water, Shoals, Tidal marshes, Tides, Marshes, Marsh plants, Land tenure, Legislation, Legal aspects, Water law, Banks, Shores, Rocks, Root systems, Conservation, Administrative agencies, Tidal waters, Mosses.
Identifiers: Seaweed, Sea moss, Rockweed, Flatsweed.

Any person collecting or carrying away seaweed or rockweed at night from the seashore below the high water mark shall be fined. Any person carrying away any seaweed cast upon flats or salt marsh by the sea or tide, without leave of the owner, shall be fined. Any person piling seaweed or rockweed below the high water mark for the purpose of hauling it away, shall be fined. Any person carrying away seaweed, rockweed or sea moss for sale or transportation outside this state shall be fined. Any person taking or uprooting growing rockweed or sea moss from the rocks, banks or shores of this state, except by cutting same with a knife so as not to injure its roots, shall be fined. Any person taking or cutting more than three bushels per day of rockweed or sea moss growing below the high water mark shall be fined. Fish and game conservation officers and all state and local police officers shall enforce all laws relating to such collecting, carrying away, uprooting, piling and selling of seaweed, rockweed, flats-weed and sea moss. (Carruthers-Fla)
W69-09860

MARINE FISHERIES.

NH Rev Stat Ann secs 211:65-211:70 (Supp 1967).

Descriptors: *New Hampshire, *Marine fisheries, *Commercial fishing, *Sport fishing, Shellfish, Commercial shellfishing, Marine fish, Permits, Regulation, Administrative agencies, Legislation, Fish conservation, Fish management, Fisheries, Oysters, Crabs, Clams, Federal government, State governments, Costs, Administrative costs, Resource development, Grants.

A division of marine fisheries is established in the department of fish and game for the purpose of regulating and promoting recreational and commercial marine fishing. 'Marine fisheries' refers to the taking of salt-water fish, crabs, oysters, clams and clam worms. The division is authorized to receive and spend gifts and grants from any source and to hold property acquired for projects approved by the Secretary of the Interior for research and development of commercial fisheries resources. The director of the fish and game department shall supervise the division, authorize expenditures from the marine fisheries fund and may hold hearings and issue regulations as provided by statute. The director shall appoint a marine biologist as chief of the division. The director shall employ such other help as is necessary for the control of marine fisheries. He may, until a permanent marine biologist is appointed, employ a consultant to set up a program and to train biologists and other employees. Such consultant may be paid $6000 a year from the marine fisheries fund, but may not be employed for a period longer than two years. Money collected from licenses, fines for taking shellfish, and gifts shall be kept in a separate marine fisheries fund to be used for expenses of the division. (Kahle-Fla)
W69-09861

PROPAGATION OF FISH AND GAME.
NH Rev Stat Ann secs 212:1-212:33 (1964).

Descriptors: *New Hampshire, *Fish management, *Fish conservation, *Administrative agencies, Legislation, Water policy, Legal aspects, Fish establishment, Fish reproduction, Fish stocking, Regulation, Permits, Administration, Fishing, Wildlife, Federal government, Condemnation, Condemnation value, Compensation, Economics, Wildlife habitats, Habitat improvement, Fish populations.

The state may condemn lands or waters for protection and propagation of fish or for fishing or administrative purposes in the event that said properties cannot be purchased or leased at a reasonable price. If the owner is dissatisfied with the payment for such properties, he may appeal the award to the county superior court. The director of the fish and game commission in conjunction with the commissioner of agriculture may establish game refuges for the protection and propagation of fish on state fish and game lands, on privately owned lands with the consent of the owner and abutters, or on state or national forest lands. The director may remove or transfer fish and he may sell or exchange fish, eggs or fry with other states or individuals in the interest of protection or propagation thereof. The state consents to the federal act of Congress dealing with fish restoration and management projects and empowers the director to consent to cooperative fish restoration and management projects. Licenses are required for those engaging in private propagation of fish. A provision limits the liability of landowners allowing the public to use their lands free of charge for hunting and fishing. (Johnson-Fla)
W69-09862

LICENSES.
NH Rev Stat Ann secs 214:1-214:23, 214:30-214:37 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Permits, *Regulation, *Freshwater fish, Control, Fishing, Fish, Legal aspects, Legislation, Water policy, Administration, Administrative agencies, State governments, Wildlife conservation, Fish management, Hunting, Smelts, Bait fishing, Baits, Bait traps, Minnows, Fishing gear.
Identifiers: *Licenses.

Before any person, resident or nonresident, may hunt, fish, or take in any manner wild animals, he must purchase a proper license which he must display on his outer garment when hunting or fishing. Members of the armed forces, minor children, and resident owners of farm lands (while fishing on their own property) are excepted from the licensing requirements. Licensees are categorized and each group pays a special fee for the type of license purchased. Any license so issued is revocable upon conviction of a violation of any provision of this chapter. Any person who violates the provisions against throwing refuse into public waters may, in addition to the penalty therefore, lose his fishing or hunting license for the current year. A bait dealer must purchase a license to sell freshwater smelt; such license also authorizes the taking of such smelt. Equipment used to take live bait must be clearly marked with the name of the owner and user. (Johnson-Fla)
W69-09863

HAMPTON HARBOR AND BEACH EROSION CONTROL.
For primary bibliographic entry see Field 04A.
W69-09864

BACK CHANNELS OF PORTSMOUTH HARBOR; SHORE AND BEACH PRESERVATION AND DEVELOPMENT.

NH Rev Stat Ann secs 216-C:1 thru 216-C:16 (Supp 1967), 217:1 (1964).

Descriptors: *New Hampshire, *Channel improvement, *Projects, *Harbors, Administrative agencies, Administrative decisions, Federal government, State governments, Federal project policy, Investigations, Erosion, Erosion control, Shores, Coasts, Currents (Water), Waves (Water), Boating, Recreation, Water sports, Cities, Federal budget, Damages, Construction, Engineering, Legislation, Water law, Legal aspects, United States, Appropriation, Cost allocation, Costs, Cost sharing.
Identifiers: Corps of Engineers.

The public works and highway department, through cooperative study and investigation with appropriate agencies of the United States government, shall attempt to devise effective means of erosion prevention relative to the coastal shores of this state. The governor is authorized to undertake, in cooperation with the Army Corps of Engineers, a project to improve the back channels of Portsmouth Harbor for small boating. In this regard, the governor is authorized to act for the city of Portsmouth and other public local interests. But, no action under this authority shall be taken except where federal funds are found to be available for such projects and where state expenditure is economically justified, the New Hampshire state port authority, with the approval of the governor, is authorized to cooperate and enter into such agreements with the federal government as are deemed advisable and to render such assurance as may be required to obtain such funds. It is anticipated that the Corps of Engineers will supervise the construction of the cooperative projects and that upon completion the federal government will maintain the dredged channels while the city of Portsmouth will operate and manage the public landings or wharves. Any contracts let for construction of the projects shall be administered by the commissioner of public works and highways. The department of public works and highways is authorized to cooperate in engineering studies with the Corps of Engineers. (Carruthers-Fla)
W69-09865

LAY OUT OF HIGHWAYS TO PUBLIC WATERS.

NH Rev Stat Ann secs 235:1 thru 235:9 (1964).

Descriptors: *New Hampshire, *Highways, *Access routes, Condemnation, Eminent domain, Damages, Appropriation, Condemnation value, Assessments, Reservoirs, Cost allocation, Costs, Cost sharing, Administrative agencies, Administrative decisions, Land tenure, Land use, Locating, Public rights, Public benefits, Compensation, Gates, Cities, Legal aspects, Legislation, Water resources, Water users.
Identifiers: Public waters.

Upon petition and hearing, the governor may determine the necessity for laying a highway access route from any existing highway to any public water in this state. The governor shall also determine its location and appoint a commission to purchase the necessary land and complete the lay out. The governor, upon petition, may appoint a commission to determine whether there is occasion for the laying out of such highway. Notice of any hearing entailed by this procedure shall be given to the first petitioner and to each affected property owner and to the clerk of any affected city or town. Damages sustained by each property owner shall be assessed by the commission, which shall also pay such damages and file a return, and in all matters pertaining to such layout shall have the same powers and duties as commissioners have in laying out class I or II highways. Any landowner aggrieved by the commission's damage assessment may appeal to the superior court and have his damages assessed by jury. Any such highway may be made subject to gates or bars across the same. No such highway shall be laid out to any public waters used by any city or town for reservoir purposes. The state shall pay such portion of the commissioner's services, damage awards and construction costs as the governor shall deem just and reasonable. The balance shall be paid by the affected towns. Such highway shall be deemed a class V highway. Towns or the state are not liable for any injury to person or property on any such highway. (Carruthers-Fla)
W69-09866

USE OF HOUSEBOATS.

NH Rev Stat Ann secs 270-A:1 thru 270-A:7 (Supp 1967).

Descriptors: *New Hampshire, *Boats, *Boating regulations, *Pollution abatement, Regulation, Legislation, Administrative agencies, Navigable waters, Surface waters, Inland waterways, Leases, Permits, State jurisdiction, Water pollution control.
Identifiers: *Houseboats, Mooring, Penalties (Civil).

The terms 'person', 'houseboat', 'overnight period', and 'mooring' are defined. A houseboat may be beached or tied to the shore of any inland surface waters of the state for an overnight period, or part thereof, only at a location owned or leased by the operator of the houseboat, by permission of the owner of such location or in case of emergency. Houseboats may not be anchored on inland surface waters except in case of emergency. The person in control of a location where one or more houseboats are anchored or moored for an overnight period, or part thereof, must give prompt notice of such fact to the New Hampshire Water Supply and Pollution Control Commission stating the number of houseboats and dates of mooring. Persons who lease spaces for mooring houseboats must keep a log of all such houseboats, the names of the owners of such houseboats and the dates of such mooring which log shall be available for inspection by the Commission. (Kahle-Fla)
W69-09867

OBSTRUCTING WATER; PENALTY.

NH Rev Stat Ann sec 249:22 (1964).

Descriptors: *New Hampshire, *Highways, *Diversion, *Obstruction to flow, Alteration of flow, Streams, Rivers, Legislation, Local governments, Administrative agencies, Highway effects, Flooding, Flood damage, Floods, Diversion.
Identifiers: Penalties (Civil).

If any person places, or allows to be placed or remain, any logs, earth or other substances near a highway thereby diverting water upon the highway and rendering it unfit for travel he shall be fined not to exceed $100. (Kahle-Fla)
W69-09868

NEW HAMPSHIRE STATE PORT AUTHORITY.

NH Rev Stat Ann secs 271-A:1 thru 271-A:14 (1966).

Descriptors: *New Hampshire, *Port authorities, *Administrative agencies, *Regulation, State governments, Federal government, Harbors, Legislation, Legal aspects, Navigable waters, Tidal waters, Boats, Boating, Fishing, Water sports, Recreation, Commercial fishing, Rivers, Transportation, Land use, Piers, Construction, Industries, Control, Operation and maintenance.
Identifiers: Harbor masters, Pilots, Ports.

There shall be established a New Hampshire State Authority. The authority shall: (1) plan for the maintenance and development of the ports, harbors, and navigable tidal rivers of the state; (2) aid in the development of salt water fisheries; (3) cooperate with federal governmental agencies; and (4) plan and develop air navigation and land transportation facilities near Portsmouth. The authority shall: (1) have the authority to work with other port authorities and the federal government for business interchange; (2) establish additional of-

fices; (3) appoint and compensate harbor masters; and (4) make such rules and regulations governing pilots and harbor masters as it deems necessary. (Carruthers-Fla)
W69-09869

PROCEEDINGS TO ACQUIRE PROPERTY OR RIGHTS.

NH Rev Stat Ann secs 371:1, 371:3, 371:4, 371:10, 371:17, thru 371:23 (1966), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Public utilities, *Compensation, *Permits, Eminent domain, Easements, Damages, Administrative agencies, Administrative decisions, Legislation, Water rights, State jurisdiction, Public rights, Riparian rights, Ponds, Streams, Shores, Legal aspects, Drainage, Flow control, Damsites, Bridges, Transmission lines, Regulation.
Identifiers: Public Utilities Commission, Public waters.

To construct transmission lines, towers, or pipelines, over, under or across any public waters of this state a public utility must petition for and secure a permit from the Public Utilities Commission. Public waters of this state are ponds of more than ten acres, tidewater bodies, and such streams as the Commission may prescribe. The Commission shall hold a hearing for all interested parties to determine if the permit may be exercised without substantial interference with public rights in the water bodies. The commission shall determine compensation due land owners affected by the permits and due the state for the grant of rights to public waters. Land owners may appeal the compensation determination to the courts. A hearing need not be held if all interested parties are in agreement or if the permit is to furnish facilities to the state. (Gadd-Fla)
W69-09870

BRIDGES--LAYING OUT AND DISCONTINUING.

Vt Stat Ann tit 19, secs 721, 722 (1968).

Descriptors: *Vermont, *Bridges, *Jurisdiction, *Local governments, Regulation, Legislation, Legal aspects, Bridge construction, Planning, Administration, Community development, Cost allocation.

When a fine is assessed for failure to build a bridge between two towns, each town pays in proportion to the amount they were assessed for the building of the bridge. However, the court must take into consideration any amount already paid by the town. Application to lay out, alter or discontinue a highway extending through two or more towns in different counties or for building a bridge between two such towns must be made to the Supreme Court which has the same power as the county court in such matters when both towns lie in the same county. (Johnson-Fla)
W69-09871

REPAIR AND MAINTENANCE OF BRIDGES.
Vt Stat Ann tit 19, secs 1331-1340 (1968).

Descriptors: *Vermont, *Bridges, *Local governments, *Repairing, Administrative agencies, Legislation, Government finance, Cost allocation, Legal aspects, Administration, Public benefits, Maintenance, Maintenance costs, Highways, Administrative decisions.

Any three citizens may give written notice that a bridge is in a state of disrepair to a selectman of the town in which the bridge is located. If repair on such bridge is not begun within thirty-six hours, such citizens may file for a hearing with the road commissioners and, upon proper notice, a hearing will be held to determine whether or not the public good demands the repair of such bridge. The commissioners may order repair to begin themselves or order the town to initiate such action within thirty days. If the town fails to initiate the proper repairs, the commissioners will appoint an agent who will immediately repair such bridge. The town is liable for payment of the costs of such repair. When a bridge is between two counties or towns, both towns are jointly liable for the repair and maintenance of such bridge. (Johnson-Fla)
W69-09872

INJURY TO HIGHWAY BY DIVERTING STREAMS.
Vt Stat Ann tit 19, sec 1523 (1968).

Descriptors: *Vermont, *Highways, *Diversion, *Obstruction to flow, Legislation, Streams, Watercourses (Legal), Sluices, Lumber, Damages, Cities, Highways, Roads, Water law, Legal aspects, Transportation.
Identifiers: Penalties (Civil).

Any person who injures a public highway by obstructing or diverting a stream, watercourse or sluice, or by dragging logs or timber on the road surface, shall be fined $10 for each offense. Such person shall be liable also to the adjacent town for damage to the highway. (Shevin-Fla)
W69-09873

WATERWAYS, DRAINAGE, FLOOD CONTROL, WATER POLLUTION AND WATER RESOURCES STUDY COMM'N.
For primary bibliographic entry see Field 04A.
W69-09874

WATER TERMINALS.

Ill Ann Stat ch 19, secs 146-149 (Smith-Hurd 1963), as amended, (Supp 1969).

Descriptors: *Illinois, *Railroads, *Water management (Applied), *Construction, Construction costs, Administrative agencies, Leases, Rates, Contracts, Legislation, Land use, State jurisdiction, Administration, Rates, Cost allocation, Repairs, Maintenance, Maintenance costs, Equipment, Legal aspects.
Identifiers: *Water terminals.

The Department of Public Works and Buildings is directed to improve certain water terminal premises in Cook County. Plans may be prepared and contracts let for said improvements by the Department. The Atchison, Topeka and Santa Fe Railway shall be liable for the costs of such improvements not exceeding an aggregate $200,000 under a prior contract. The Department may lease, for periods not exceeding 10 years, portions of the improved property to any financially responsible person or corporation. Such lessees must agree to satisfactorily maintain the facilities, to pay a reasonable rent, and, in the case of private lessees, to furnish a bond to insure performance of the lease. The Department may not sell any part or all of said terminals, but may sell obsolete, used or excess materials and apparatus of any kind. (Kahle-Fla)
W69-09875

SUBMERGED LAND.

Ill Ann Stat ch 19, secs 150-151 (Smith-Hurd 1963).

Descriptors: *Illinois, *Beds, *Landfills, *Ownership of beds, Beds under water, State jurisdiction, Remedies, Legislation, Land use, Land tenure, State governments, Legal aspects, Relative rights, Land, Land reclamation, Land resources, Public benefits, Allotments.

The state of Illinois reclaims title to submerged state lands, land formerly submerged and illegally filled, and lands allotted to any person or corporation which have been illegally filled in or which are not used for purposes allotted. The attorney general is directed to bring such suits as are necessary in order to protect the people of the state and to recover such lands or protect such lands from encroachment or illegal occupation. (Kahle-Fla)
W69-09876

SEWAGE DISPOSAL.
For primary bibliographic entry see Field 05G.
W69-09877

DAVID MEYEROWITZ AND SON INC V 61 GREENPOINT AVE INC (ACTION TO RECOVER POSSESSION OF REAL PROPERTY).
300 NYS 2d 810-811 (1969).

Descriptors: *New York, *Bridges, *Boundary disputes, *Real property, Land tenure, Encroachment, Judicial decisions, Legal aspects, Relative rights, Water law.

Defendants were owners of a bridge and passageway which, as determined by the court, encroached upon plaintiff's property. The court ordered the bridge removed at defendant's expense. The defendants appealed. The appellate court held that the defendants could not use that portion of the bridge which encroached over plaintiff's property but reversed the lower court's ruling that the defendant must remove the bridge by further holding that the evidence as to ownership of the bridge was insufficient to prove that defendants owned it. (Shevin-Fla)
W69-09878

6F. Nonstructural Alternatives

PILOT PLANNING STUDY FOR AREA WIDE STORM DRAINAGE PLANNING.
Wright-McLaughlin Engineers, Denver, Colo.
For primary bibliographic entry see Field 04A.
W69-09774

MERRIMACK RIVER FLOOD CONTROL COMPACT.

NH Rev Stat Ann secs 487-A:1 thru 487-A:5 (1968).

Descriptors: *New Hampshire, *Administrative agencies, *Interstate compacts, *Interstate commissions, Legislation, Administration, Regulation, Water resources, Natural resources, State governments, Water policy, Dams, Flood control, Storage, Water resources development, Taxes.

New Hampshire enters into the Merrimack River Flood Control Compact with Massachusetts in order to promote interstate comity among and between the signatory states, to provide adequate storage capacity for impounding the waters of the Merrimack River and its tributaries, and to provide a joint and common agency through which the signatory states may effectively cooperate in accomplishing the object of flood control and water resource utilization in the Merrimack River basin. The Merrimack River Valley Flood Control Commission is created, the duties of which are enumerated herein. Agreements between New Hampshire and Massachusetts as to the sites of certain dams and reimbursement to New Hampshire by Massachusetts of lost tax moneys, economic losses, and damages occasioned by the provisions of the Compact, together with applicable procedural steps pertinent thereto are set forth. Compact notice and recording procedures as well as provisions for the appointment and compensation of flood control commissioners are set forth. (Moulder-Fla)
W69-09810

CONNECTICUT RIVER FLOOD CONTROL COMPACT.
NH Rev Stat Ann secs 487:1 thru 487:5 (1968).

Descriptors: *New Hampshire, *Interstate compacts, *Administrative agencies, *Interstate commissions, Legislation, Administration, Regulation, Water resources, Natural resources, State governments, Water policy, Dams, Flood control, Reservoirs, Storage, Water resources development, Taxes.

New Hampshire enters into the Connecticut River Flood Control Compact with Massachusetts, Connecticut, and Vermont in order to promote interstate comity, to assure adequate storage capacity for impounding the waters of the Connecticut River and its tributaries, and to provide a joint and common agency through which the signatory states may more effectively cooperate in accomplishing the object of flood control and water resource utilization in the Connecticut River basin. The Connecticut River Valley Flood Control Commission is created. The Commission's constitution, purposes, and duties are enumerated. Agreements between the signatory states as to reimbursement for taxes lost to political subdivisions due to agreements relating to construction of flood control dams and reservoirs by the federal government are included. The Compact is effective when ratified by Massachusetts, New Hampshire, Vermont, and Connecticut and approved by Congress. Compact notice and recording procedures as well as provisions for the appointment and compensation of commissioners are set forth. (Moulder-Fla)
W69-09811

6G. Ecologic Impact of Water Development

WATER RESEARCH PROGRAMS - AQUATIC COMMUNITIES,
Academy of Natural Sciences, Philadelphia, Pa. Dept. of Limnology.
Ruth Patrick.
US Dep Interior, Office of Water Resources Res Rep, Mar 1968. 22 p, 9 ref. OWRR Contract No 14-01-0001-1569.

Descriptors: *Reviews, *Ecology, *Ecosystems, Food chains, Productivity, Eutrophication, Water pollution effects, Lakes, Streams, Estuaries.
Identifiers: Aquatic ecosystems.

The present state of knowledge about the structure and functioning of aquatic ecosystems and how nutrients and energy are cycled through them is reviewed, and programs of research in these subjects are discussed. Knowledge as to the effects of various types of pollution on these ecosystems is discussed. Fields of research which need to be pursued in order to understand the structure and functioning of aquatic ecosystems are outlined. The kinds of basic studies needed in order to understand the effects of various types of pollution or perturbation, and how they can be diagnosed are discussed. Ways in which research in this important field should be implemented are suggested. (Knapp-USGS)
W69-09508

WATER POLLUTION IN REMOTE RECREATIONAL AREAS,
Forest Service (USDA), Duluth, Minn. Superior National Forest.
For primary bibliographic entry see Field 05G.
W69-09661

07. RESOURCES DATA

7A. Network Design

DETERMINING RAIN GAUGE DENSITIES IN ENGLAND FROM LIMITED DATA TO GIVE A REQUIRED PRECISION FOR MONTHLY AREAL RAINFALL ESTIMATES,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
P. H. Herbst, and Elizabeth M. Shaw.
J Inst Water Eng, Vol 23, No 4, p 218-230, June 1969. 13 p, 4 fig, 2 tab, 7 ref.

Descriptors: *Rain gages, *Network design, *Statistical methods, Rainfall-runoff relationships, Gaging stations, Hydrologic data, Regional analysis.
Identifiers: *United Kingdom, Rain gage network density.

In demonstrating the analysis of rainfall observations from rain gauge networks in an attempt to determine the optimum densities required for given conditions, the selection of a range of catchments from different parts of England has produced results that reflect the variability of the precipitation pattern. It is obvious that the several statistics do not fit easily into simple relationships. From the foregoing discussion of the results, it might be suggested that the study of required network densities might produce more conformable figures if done on a regional basis. A t test on the 5 in. monthly rainfall line at 2.5% precision indicates that, for the relationship of the required gauge density to the long-term areal averages, there is only a 2.5% chance of this occurring by chance. Once a rain-gauge network has been installed and reliable observations are assembled, then the standard techniques of analysis are carried out. When a few years of data are available, checks on the quality can be made and tentative estimates of the station standard annual averages can be evaluated. A greater density of gauges than indicated in this study would be essential to assess daily areal precipitation, and to ensure the measurement of intense local storms. (Knapp-USGS)
W69-09673

7B. Data Acquisition

PRODUCTION OF ISOLATED PAIRS OF WATER DROPS HAVING UNEQUAL RADII,
National Center for Atmospheric Research, Boulder, Colo.
Charles E. Abbott.
The Rev Sci Instrum, Vol 40, No 9, p 1227-1230, Sept 1969. 4 p, 5 fig, 6 ref.

Descriptors: *Instrumentation, *Rainfall simulators, *Artificial precipitation, *Simulated rainfall, Laboratory tests, Rain.
Identifiers: Water-drop pair production, Raindrop interaction.

To extend laboratory investigations of the effects of electric charges and fields on colliding water drops, a technique has been developed for simultaneously producing pairs of drops with unequal radii. Radius ratios as large as 10 to 1 can be obtained with drops having radii in the range 0.1-1 mm. Continuous production of drop pairs is possible, with the desired repetition rates selected by electronic controls and unwanted drop pairs deflected out of the observation volume. Successive pairs, thus produced, are sufficiently identical that a sequence of photographs has been obtained with an effective elapsed time between exposures of 100 microsec, the equivalent of 10,000 frames/sec in terms of high speed photography. (Knapp-USGS)
W69-09448

CARBON-14 IN PATAGONIAN TREE RINGS,
Groningen Rijksuniversiteit (Netherlands). Physics Lab.
J. C. Lerman, W. G. Mook, J. C. Vogel, and H. de Waard.
Science, Vol 165, No 3898, p 1123-1125, Sept 12, 1969. 3 p, 2 fig, 18 ref.

Descriptors: *Paleoclimatology, *Radioactive dating, *Carbon radioisotopes, *Dendrochronology, Carbon cycle, Trees, Plant growth, Quaternary period.
Identifiers: Patagonia, Atmospheric radioactivity.

The radiocarbon activity found in tree rings from southern Argentina shows secular fluctuations which are synchronous with and of the same amplitude as those known for the Northern Hemisphere. Comparable measurements indicate that the activity in Patagonian trees is about five per mil lower than in European trees. (Knapp-USGS)
W69-09450

A COMBINED CONTROL-METERING SECTION FOR GAGING LARGE STREAMS,
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest Range Experiment Station.
Harry E. Brown.
Water Resources Res, Vol 5, No 4, p 888-894, Aug 1969. 7 p, 7 fig, 2 ref.

Descriptors: *Stream gages, *Instrumentation, *Discharge (Water), Streamflow, Weirs, Flumes, Gages, Depth, Watershed management, Flow measurement, Water control, Water levels, Stage-discharge relations.
Identifiers: Stream metering structures.

Two stream gaging stations of new design were constructed and tested on the Beaver Creek pilot watershed in Arizona. The gage provides a stable stage discharge relations with sufficient precision for long-term hydrologic investigations. The control surface is a concrete slab 15 ft wide with a 6-inch triangular lip built into the downstream edge. Flow is metered on the concrete surface near the upstream edge of the slab. Capacity of the gage is in excess of 1000 cfs; field ratings up to 705 cfs are presented. (Knapp-USGS)
W69-09471

THERMAL AND ELECTRICAL CONDUCTIVITIES OF SANDSTONE ROCKS AND OCEAN SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Oceanography; and National Academy of Sciences-National Research Council, Washington, D.C. Div. of Earth Sciences.
For primary bibliographic entry see Field 02F.
W69-09498

MEASUREMENT OF SAND TRANSPORT IN RIVERS WITH SPECIAL REFERENCE TO TRACER METHODS,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 02J.
W69-09507

MOTION MEASUREMENT BY LASER DOPPLER TECHNIQUES,
Case Western Reserve Univ., Cleveland, Ohio; and National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
John C. Angus, David L. Morrow, and John W. Dunning, Jr.
Ind Eng Chem, Vol 61, No 2, p 8-20, Feb 1969. 13 p, 14 fig, 1 tab, 112 ref.

Descriptors: *Laser, *Velocity meters, Measuring instruments, Light waves, Optical instruments, Motion, Bibliographies, Molecules, Laminar flow, Instrumentation, Fluid flow, *Flowmeters, *Flow measurement, Hydraulics, Physics, Vibrations.
Identifiers: Doppler effect, Light beams, Light-scattering method, Brownian movement.

Velocity measurements may be made by detecting the Doppler shift of laser light scattered from a

moving object. The paper discusses laser Doppler velocity meters for measuring the motion of fluids or macroscopic objects and methods for determining molecular motions. The most important present applications include fluid flow measurements, vibration analysis, and transport property measurements in fluids. Potential applications include measurement of particle size distribution, chemical reaction rate constants, and velocity sensing for automatic control devices. The method may find research uses in crystal nucleation and growth studies, emulsion polymerization, measurement of spectra and correlation functions in turbulent flow, and studies of conformations of macromolecules in solution. The method is accurate, almost instantaneous, does not disturb the system being measured, has a high spatial resolution, and can measure velocities as low as 0.001 cm/sec. (USBR)
W69-09526

TRAPEZOIDAL FLUMES FOR MEASURING FLOW IN IRRIGATION CHANNELS,
Agricultural Research Service, Kimberly, Idaho.
A. R. Robinson.
Pap ARS 41-140, Agr Res Serv, Mar 1968. 15 p, 8 fig, 6 tab, 3 ref, append.

Descriptors: *Flumes, *Flow measurement, *Discharge measurement, Head loss, *Water measurement, Energy losses, Hydraulics, Irrigation canals, Ditches, Parshall flumes, Comparative benefits, Canals, Unlined canals, Channels, Submergence, Slopes.
Identifiers: *Trapezoidal flumes, Submerged flow, Free flow, Lined canals, Rectangular channels.

Trapezoidal flumes are superior to rectangular or Parshall-type flumes for measuring small flows. These flumes can be constructed as an integral part of a lined canal or made of metal, fiberglass, or wood and installed in the channel. The shape conforms to the normal shape of lined or unlined ditches. The trapezoidal shape is desirable because the width of water surface increases as the depth increases. This means that one structure can convey a larger range of flow; the entire range of depth for a given range of discharge is smaller. Operational characteristics of trapezoidal flumes are superior because less backwater will result and a shallower section will be required than for a rectangular shape. Another desirable feature of the trapezoidal flume is the flat bottom throughout rather than a dropped section as in the Parshall flume. No particular advantage of a crest section with a drop in the floor such as in the Parshall flume has been found. Submergence to a maximum of 80% can be allowed before corrections are necessary. For flows with submergence in excess of 80%, flow corrections can easily be made. The total head loss through the trapezoidal structure may be less for comparable discharges than for the Parshall flume. (USBR)
W69-09532

AERIAL PHOTOGRAPHS FOR OPERATIONAL STREAMFLOW FORECASTING IN THE COLORADO ROCKIES,
Forest Service, Fort Collins, Colo.
Charles F. Leaf.
Pap, 37th Annu Meet, West Snow Conf, Salt Lake City, Utah, Apr 1969. 16 p, 12 fig, 2 tab, 8 ref.

Descriptors: *Aerial photography, *Runoff, *Snowmelt, Hydrologic data, *Snowpacks, Snow surveys, *Runoff forecasting, *Streamflow forecasting, Hydrology, Small watersheds, Optimum use, Hydrographs, *Rocky Mountain Region, Colorado.
Identifiers: *Rocky Mountains, Fraser Experimental Forest, Colo.

Prediction and simulation of runoff from snowmelt are important to the economic and efficient operation of engineering systems supplying and controlling water. In 1964, the Forest Service initiated a program to collect snow cover data on a routine basis. Low-level air photos, supplemented by ground observations, were used to observe the areal extent of snow cover at about 10-day intervals after snow melt began. Results from 3 small watersheds in the Fraser Experimental Forest, Colo, are discussed. Each of the 3 watersheds has a characteristic functional relationship between the extent of snow cover during the melt season and accumulated runoff. Observed year-to-year deviations may have physical significance that can be explained by differences in initial snowpack water equivalent, soil moisture requirements, and meteorological conditions during snowmelt. Subjective interpretation of the photos may account for much of the scatter around mean curves. Importance of snow cover information in various streamflow forecasting methodologies justifies continued research to develop more objective techniques for accurately obtaining this type of information from aerial photographs. Several more years of record are needed so that the entire range of hydrologic conditions at various stages of snowpack depletion are sampled. (USBR)
W69-09539

A 2-YEAR EVALUATION OF THE SNOWMELT LYSIMETER,
Forest Service (USDA), Moscow, Idaho.
Harold F. Haupt.
Pap, 37th Annu Meet West Snow Conf, Salt Lake City, Utah, Apr 1969. 8 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Lysimeters, Snow management, *Snowmelt, Snowpacks, Melt water, Rainfall, Runoff, Hydrologic instruments, Measuring instruments, Instrumentation, Runoff forecasting, Evaluation, Hydrology, Maintenance costs, Costs, *Snow.

The Forest Service operated a snowmelt lysimeter during the 1966-67 and 1967-68 winters at the Priest River Experimental Forest in northern Idaho. The lysimeter has a surface area of 2.72 sq ft and measures the outflow from the base of a column of undisturbed snow. Direct measurements are provided for melt output during clear weather and rain percolate plus melt during rainy periods; the lysimeter does not provide continuous assessment of snow input or water equivalent of the snowpack. The apparatus consists of a catchment trough with an outlet drain, an underground drain hose, and a catchment tank and recorder system. The operation of the installation is described and results are given. The lysimeter is low in construction and maintenance costs, is accurate, and there is practically no loss of records from malfunctions. (USBR)
W69-09545

INSTRUMENTATION FOR HYDRAULIC MEASUREMENTS IN LABORATORY AND FIELD STUDIES,
Bureau of Reclamation, Denver, Colo.
J. C. Schuster.
Bur Reclam Rep No Hyd-592, May 1969. 29 p, 4 fig, 3 tab, 25 photo.

Descriptors: Hydraulics, *Instrumentation, Measurement, Conductivity, *Measuring instruments, Temperature, Pressure, Velocity meters, Pressure sensors, Hydraulic conductivity, *Recording systems, Velocity, Hydraulic models, *Laboratory equipment, Pressure measuring instruments, Hydraulic transients, *Hydraulic equipment, Hydraulic engineering.
Identifiers: Instrument transformers, Analog instruments, Analog-to-digital converter, Pressure transducers.

Photographs and descriptive captions of instruments are presented to indicate some possible instrumentation systems used by the Hydraulics Branch of the Bureau of Reclamation. The described instrument combinations are not exhaustive, but show the capabilities of instruments purchased on a modest budget. One motive for selecting this equipment was the interchangeability of components. An instrumentation system assembled for a particular study may be reassembled into other systems for different investigations. The equipment includes measurement and recording systems for pressure, electric conductivity, temperature, velocity distribution, flow tracing, boundary shear, surge waves, wave height, and analog-to-digital conversion. (USBR)
W69-09546

A GUIDE TO THE GENERATION OF LIAPUNOV FUNCTIONS,
International Business Machines Corp., New York; and Princeton Univ., N.J.
For primary bibliographic entry see Field 08B.
W69-09554

TECHNIQUES OF HYDROLOGIC RESEARCH IN FORESTED PEATLANDS, U.S.A.,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
Roger R. Bay.
XIV IUFRO Congress, Munich, Vol 1, p 400-415, 1967. 6 p, 4 fig, 4 tab, 19 ref.

Descriptors: *Bogs, *Swamps, *Instrumentation, *Watersheds (Basins), Water measurement, Demonstration watersheds, Hydrogeology, Water table, Streamflow, Stream gages, Forestry, Organic soils, Minnesota.
Identifiers: *Bog hydrology, *Peatlands, *Forested watersheds, Wetland hydrology.

The hydrology of bog watersheds in the northern United States is being studied with controlled field experiments utilizing the calibrated watershed approach. Although this technique has been used on upland and mountainous watersheds it has rarely if ever been used in studies of peatland hydrology. Research techniques and instrumentation have been modified or developed to cope with unusual problems in peatlands. Groundwater wells in the study bogs and hydrogeologic investigations on the surrounding watershed area have proven invaluable in the interpretation of bog water table fluctuations and bog groundwater relationships. During the pre-treatment period, precipitation, runoff, and groundwater data collected on six experimental bogs have already yielded important information on the hydrology of natural, forested bog watersheds. Laboratory and field experiments in organic soils have also provided new information on the physical properties of peat materials. Data on water retention and hydraulic conductivities of peats in situ have explained water table reactions to precipitation input and evapotranspiration output under natural conditions. These data should also help explain land treatment effects, and aid in the extension of hydrologic principles to other peatland complexes.
W69-09571

IMPORTANCE OF VOLUMETRIC EXPRESSION OF WATER CONTENTS OF ORGANIC SOILS,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 02G.
W69-09575

PLANNING AND INTERPRETING SOIL PERMEABILITY MEASUREMENTS,
Agricultural Research Service, Phoenix, Ariz., Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W69-09658

INFERENCE OF STRATOSPHERIC TEMPERATURE AND MOISTURE PROFILES FROM OBSERVATIONS OF THE INFRARED HORIZON,
GCA Corp., Bedford, Mass.
For primary bibliographic entry see Field 02B.
W69-09659

AN INTERFACE PROBLEM WITH A SOURCE AND A SINK IN THE HEAVY FLUID,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 02L.
W69-09668

A PREFABRICATED FLAT-VEE WEIR FOR EXPERIMENTAL CATCHMENTS,
Durham Univ. (England). Dept. of Geography.
K. Smith, and M. E. Lavis.
J Hydrol, Vol 8, No 2, p 217-226, June 1969. 10 p, 3 fig, 11 ref.

Descriptors: *Weirs, *Discharge measurement, *Flow measurement, Streamflow, Runoff, Flowmeters, Gages, Gaging stations, Discharge (Water), Stream gages.
Identifiers: Portable weirs.

The choice and method of construction of a prefabricated flat-vee weir designed to operate in a small upland catchment are described. The considerations outlined are directly related to the conditions imposed by the upland environment, but such a structure will be of general application where there is a need for an accurate but relatively cheap portable and easily installed structure for short-term hydrological studies in experimental basins. (Knapp-USGS)
W69-09670

CALIBRATING A WATERSHED BY USING A CLIMATIC DATA,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02A.
W69-09759

A METHOD OF ESTIMATING STREAMFLOW LOSS BY EVAPOTRANSPIRATION FROM THE RIPARIAN ZONE,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02D.
W69-09760

7C. Evaluation, Processing and Publication

AN ASSESSMENT OF THE NATION'S WATER RESOURCES,
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 06B.
W69-09452

CHARACTERISTIC RESPONSE TIMES IN DESIGN FLOOD ESTIMATION,
New South Wales Univ., Kensington (Australia); and Ministry of Public Works (Cambodia).
For primary bibliographic entry see Field 02E.
W69-09667

POTENTIAL EVAPOTRANSPIRATION AND CLIMATE IN ALASKA BY THORNTHWAITE'S CLASSIFICATION,
Pacific Northwest Forest and Range Experiment Station, Juneau, Alaska. Inst. of Nothern Forestry; and State Univ., of New York, Syracuse. Dept. of Watershed Management.
For primary bibliographic entry see Field 02D.
W69-09698

UNSTEADY FLOW SIMULATION IN RIVERS AND RESERVOIRS,
Tennessee Valley Authority, Knoxville.
Jack M. Garrison, Jean-Pierre P. Granju, and James T. Price.
Journal of the Hydraulics Division, ASCE, Vol 95, No HY5, Proc Paper 6771, p 1559-1576, Sep 1969. 18 p, 12 fig, 1 tab, 2 append.

Descriptors: *Unsteady flow, *Simulation, Rivers, Reservoirs, Transient flow, Hydraulics, Computers, *Open channels, Waves, Field measurements.
Identifiers: *Stream channels, Turbine operations, Tennessee Valley, Water flow, *TVA.

A digital computer program for solving the basic equations of unsteady flows in reservoirs and natural rivers is being used by the TVA to solve a variety of open-channel flow problems. The mathematical model, which has been proven with field measurements is capable of accurately predicting variations in water surface elevations, mean velocities, and flows with respect to time at any point along a stream.
W69-09725

DIGITAL COMPUTER SIMULATION OF TRANSIENT FLOWS IN THE TVA SYSTEM,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 08B.
W69-09726

STOCHASTIC PROGRAMMING: A SURVEY,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06A.
W69-09772

ASPECTS OF WATER RESOURCES LAW IN MINNESOTA,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W69-09794

STATE JUDICIAL CLASSIFICATIONS OF WATER AND STATE JUDICIAL DETERMINATION OF RIGHTS IN NATURAL SURFACE WATERCOURSES,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06E.
W69-09795

08. ENGINEERING WORKS

8A. Structures

NEW TECHNIQUES OF RECLAMATION CONSTRUCTION,
Bureau of Reclamation, Denver, Colo.
B. P. Bellport.
Prepr 826, Amer Soc Civ Eng Annu Nat Meet Water Resour Eng, New Orleans, La, Feb 1969. 43 p, 9 fig.

Descriptors: *Construction, Creativity, Construction equipment, Earth handling equipment, Tunneling machines, Pumping plants, Aesthetics, Soil cement, Shafts (Excavations), Blasts, Excavation, Photogrammetry, Cross-sections, Tunnel construction, Aerial photography, Critical path method, Safety, Borehole cameras, Specifications, Value engineering.
Identifiers: Innovation, *Bureau of Reclamation, Radial jacking tests, *Construction methods, *Cost savings.

New techniques being employed in constructing Bureau of Reclamation structures and facilities in the 17 Western States are described. Some Bureau efforts for advancing the administration of construction contracts through improvements in specification provisions are discussed. New advances in construction safety and research activities that will influence developing new construction techniques are reviewed. In meeting future challenges, the engineering profession and construction industry must devise new construction techniques to accomplish work economically and expeditiously, and use their technologies and experience to provide an improved environment reflecting the relationship of man to his needs and the high standard of living enjoyed in this country. The resourcefulness and skills of engineers and contractors will be challenged as water resources projects grow in magnitude and complexity and as the Nation's needs for water continue to mount. (USBR)
W69-09522

EFFECT OF OPENINGS ON DESIGN OF SUBSURFACE DRAINS,
Ohio State Univ., Columbus; and Iowa State Univ. of Science and Technology, Ames.
Glenn O. Schwab, Darrell W. DeBoer, and Howard P. Johnson.
Proc Amer Soc Civ Eng, J Irrig Drain Div, Vol 95, No IRI, p 199-209, Mar 1969. 11 p, 6 fig, 17 ref, 2 append.

Descriptors: *Subsurface drains, Drainage, *Drainage systems, Drainage engineering, Drains, Effects, *Drain tiles, Water table, Drawdown, Flow, Inflow, Outflows, Bibliographies, Joints (Connections), Joints, *Slots, Tile drains, Porosity.
Identifiers: Drain holes, *Openings, *Open drains, *Holes, Drawdown curves, Effect, *Perforations, Inflow-outflow measurement, Spacing.

Theoretical effects of joint spacing and of perforations on flow into 1-ft lengths of drain tile are presented. Results show relative inflow rates and the effect on water table drawdown for 6-in.-dia drains 4 ft deep. Field results show that the theoretical effect of joint spacing can be applied to the drawdown case if the water table midway between the drains is at least 2 ft above the center of the drain tile. The studies also provided some verification of the theory applicable to perforations. Spacings of perforations on the cylindrical surface of a drain has little effect on inflow when the ratio of shortest to longest spacing is greater than 0.2. Uniform spacing is recommended. From data presented, the effect on water table drawdown can be estimated for perforations or joints and the effect of a combination of joints and perforations can be approximated. A desired increase in flow may be obtained by adding perforations or by increasing the joint spacing on short lengths of drains. For a given drainage rate, depth, and diameter of drain, increasing the joint spacing (or perforations) increases the drawdown rate. The effect of joint spacing on drawdown rates increases as the drain spacing and soil porosity decrease. (USBR)
W69-09533

EARTH PRESSURES ON OTTAWA-OUTFALL SEWER TUNNEL,
National Research Council of Canada, Ottawa (Ontario).
W. J. Eden, and M. Bozozuk.
Can Geotech J, Vol 6, No 1, p 17-32, Feb 1969. 16 p, 10 fig, 6 ref.

Descriptors: *Earth pressure, *Sewers, Tunnel design, *Tunnel pressures, Tunnel linings, Tunnels, Overburden, Overconsolidation, Clays, Soil mechanics, *Soil pressure, Foreign design practices, Pore water pressures, Piezometers, *Settlement, Instrumentation.
Identifiers: Piezometric head, Canada, Pressure cells, Leda clay, Ottawa sewer plant.

Measurements of surface settlement, changes in piezometric levels, and earth pressures were made on a 10-ft-dia tunnel in Ottawa, Canada. The tunnel passes through extremely sensitive and moderately overconsolidated Leda clay. The instrumentation is described, and results are given for a period covering 1 yr before construction to 4 yr after completion. Results are compared with measurements on a similar tunnel in Detroit clay. Measurements were made on a flexible temporary steel lining and on the rigid permanent reinforced concrete lining. Very little surface settlement was measured because of overconsolidation in the clay and the construction method. The tunnel acts as a drainage sink and influences the piezometric regime in the clay. Earth pressures agreed with previous tunnel measurements, showing that verti-

cal pressures approach the full overburden pressure. (USBR)
W69-09536

BRIDGES OVER STATE BOUNDARY LINE STREAMS.
For primary bibliographic entry see Field 06E.
W69-09634

8B. Hydraulics

THRESHOLD PRESSURE PHENOMENA IN POROUS MEDIA,
Phillips Petroleum Co., Bartlesville, Okla.; and Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 02F.
W69-09504

MODEL STUDIES OF AN ARMOURED ROCKFILL OVERFLOW DAM,
International Engineering Co., Inc. San Francisco, Calif.
G. S. Sarkaria, and Burton H. Dworsky.
Water Power, Vol 20, No 11, p 455-462, Nov 1968. 8 p, 13 fig, 6 ref.

Descriptors: *Rockfill dams, *Spillways, Model tests, Gradation, Earth dams, *Model studies, *Hydraulic models, *Slope protection, Scour, Test procedures, Seepage, Safety factors, Pressure head, Zoned embankments, Filters, Erosion control, Tailwater.
Identifiers: *Overtopping, Piping (Erosion), Self-spillway dams.

Hydraulic model studies were conducted for a proposed armored overflow embankment of an afterbay regulation dam on the Yuba River, Calif. Planning studies indicated that substantial economic advantages would result from using the overflow embankment in lieu of a conventional concrete spillway. Armor protection for the crest and downstream face will prevent surface erosion of the embankment during overtopping. Armor protection for the apron, in conjunction with a high natural tailwater, will prevent scour of the tailrace channel at the toe of the dam during overtopping. Seepage pressures that develop when the entire discharge occurs through the dam during periods of nonovertopping streamflow are less than critical, and will not produce flotation of material at the downstream toe of the dam. Seepage pressures in the embankment during periods of overtopping discharges are not excessive and will probably not produce flotation of material near the downstream face of the dam. Suitable gradation of materials within the zoned embankment will prohibit the initiation of piping at the interfaces of the zones. (USBR)
W69-09531

INFLUENCE OF LINE MOTION ON WATER-HAMMER PRESSURES,
Kentucky Univ., Lexington.
Don J. Wood.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 95, No HY3, p 941-959, May 1969. 19 p, 15 fig, 1 tab, 19 ref, 2 append.

Descriptors: *Structural analysis, *Pipe flow, Pipelines, *Water hammer, *Hydraulics, Surges, Fluid flow, Hydraulic transients, Wave action, Hydraulic valves, Fluid friction, Closing, Pressure, Motion, Bibliographies.
Identifiers: Pressure waves, Transient flow, Analytical method.

Large pressure increases following rapid valve closures in liquid flow pipe systems produce forces that must be resisted by the system structure. These forces produce pipeline motion, usually of small amplitude and generally ignored in water hammer analysis. The motion may produce pressures that differ significantly from those predicted using rigidly supported pipelines. Initial pressure surges having magnitudes greater than 20% above the commonly used maximum for instantaneous valve closure may result under certain combinations of structural parameters and closing conditions; subsequent surges can be much greater than the initial surge. Under other conditions, the pressure buildup is retarded significantly and the line motion can be used to control water hammer pressures. Line motion associated with water hammer surge can produce characteristics such as pressure overshoot and jagged portions of the pressure trace that have often been observed experimentally. (USBR)
W69-09550

DESIGN OF ROUGHNESS ELEMENTS FOR ENERGY DISSIPATION IN HIGHWAY DRAINAGE CHUTES,
Virginia Polytechnic Inst., Blacksburg.
Henry M. Morris.
Highw Res Rec, No 261, p 25-37, 1969. 13 p, 5 fig, 15 ref.

Descriptors: *Energy dissipation, *Roughness (Hydraulic), Field tests, *Chutes, *Channels, Channel flow, Hydraulic jump, Hydraulic design, Flow control, Turbulent flow, Spillways, Laboratory tests, Hydraulic models, Bibliographies, Roughness, Hydraulic structures, Stilling basins.
Identifiers: (Energy dissipators, Roughness projections, Chute blocks, Channel design, Spillway profiles, Critical velocity.

A recurring need in hydraulic engineering is a simple, reliable method for dissipating excess energy in storm water flowing down steep drainage channels. This problem has been handled by some form of stilling basin at the channel outlet. An alternate method is the provision of roughness elements in the channel. Such elements can be designed to produce the phenomenon of tumbling flow in the channel. This is a cyclically uniform flow consisting of a series of hydraulic jumps and overfalls, assuring that the channel outlet velocity will not exceed the known critical velocity for the given discharge. Laboratory and field studies have been conducted to develop design criteria for this method of energy dissipation. The study indicates that either 2-dimensional square elements or cubical elements should be used. Design equations and recommendations for spacing and placing elements are presented. (USBR)
W69-09552

A GUIDE TO THE GENERATION OF LIAPUNOV FUNCTIONS,
International Business Machines Corp., New York; and Princeton Univ., N.J.
Okan Gurel, and Leon Lapidus.
Ind Eng Chem, Vol 61, No 3, p 30-41, Mar 1969. 12 p_f 1 fig, 1 tab, 69 ref.

Descriptors: Mathematics, *Mathematical analysis, *Differential equations, *Stability analysis, Dynamics, Reviews, Matrix algebra, Bibliographies, Transformations, Nonlinear systems, Optimization, Equations, *Control systems, Automatic control, Analytical techniques, Systems analysis.
Identifiers: *Liapunov theorem, Dynamic equilibrium, Eigenvalues.

Liapunov's direct method of stability analysis treats the stability of ordinary differential equations and tries to answer the question of whether the solution remains arbitrarily close to an equilibrium solution after being disturbed. The analysis is accomplished by the Liapunov function and its total derivative which is examined for certain properties. The theorems for Liapunov's method are discussed; methods for constructing the functions are described. Use of this method for analyzing a specific physical system requires in-depth searching of the literature in many diverse fields to ascertain recent developments. This paper enables a novice to approach the literature in a rational manner. (USBR)
W69-09554

SUCCESSFUL SAND CONTROL DESIGN FOR HIGH RATE OIL AND WATER WELLS,
Signal Oil and Gas Co., Los Angeles, Calif.
For primary bibliographic entry see Field 02J.
W69-09649

TRANSIENT FUNCTIONS FOR LAND DRAINAGE,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 02F.
W69-09654

WELL CAPACITY FOR CONTINUOUS PERMEABILITY VARIATION,
Northwestern Univ., Evanston, Ill., Technological Inst.; and Soil Testing Espanola, Madrid.
R. J. Krizek, W. H. Baker, and A. G. Franklin.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IR3, Pap 6785, p 409-414, Sept 1969. 6 p, 1 fig, 2 ref, append.

Descriptors: *Water wells, *Specific capacity, *Permeability, *Groundwater movement, *Mathematical studies, Model studies, Mathematical models, Drawdown, Flow, Porous media, Anisotropy, Artesian wells, Water yield.
Identifiers: Fracturing (Aquifers), Acid treatment (Aquifers).

The results of an analysis of the relative effects of continuous, radially symmetric permeability variations on the capacity of a single artesian well are graphically presented. Such variations may result from acid treatment, fracturing, effects incident to mud-drilling, or from structural alterations in soil adjacent to a well. The change in permeability was assumed to be maximum at the well face and to decrease exponentially in a radial direction away from the well axis. The resulting equation for relative well capacity was integrated numerically for various cases to yield a family of curves which, together with estimates of the altered and original permeability values and of the radial extent of the permeability change, can be used to quickly obtain estimates of well performance. (Knapp-USGS)
W69-09656

UNSTEADY FLOW SIMULATION IN RIVERS AND RESERVOIRS,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 07C.
W69-09725

DIGITAL COMPUTER SIMULATION OF TRANSIENT FLOWS IN THE TVA SYSTEM,
Tennessee Valley Authority, Knoxville.
B. J. Buehler, Jack M. Garrison, J. P. Granju, and J. T. Price.
Proceedings Vol 1 (Subject A) Thirteenth Congress of the International Association for Hydraulic Research, Kyoto, Japan, p A38-1--A38-8, Sep 1969. 8 p, 4 fig, 1 tab.

Descriptors: Unsteady flow, *Simulation, Rivers, Reservoirs, *Transient flow, Hydraulics, Computers, *Open channels, Waves, Field measurements.
Identifiers: *Stream channels, Turbine operations, Tennessee Valley, Water flow, *TVA.

During the past 2 years major advances have been made by TVA using the digital computer to solve the basic differential equations describing the transient behavior of water in open channels. TVA's mathematical model uses an explicit scheme to compute discharge, stage, and velocity transients from known boundary and initial conditions. In this scheme, finite difference representations of the differential equations of continuity and motion are solved. Stage, flow, or rating curve boundary conditions, local inflows, variable roughness along the channel, and actual channel geometry can be used. Steady or transient flows and stages along the channel may be given for initial conditions. Results from four studies show the diverse range over which the model has been applied. These are two reservoirs, a

natural river, and an uncontrolled canal connecting two reservoirs. Calculated results and field measurements are in excellent agreement in each of the four cases. Once verified the mathematical model becomes an invaluable tool for predicting the transient response to any type of operation.
W69-09726

8C. Hydraulic Machinery

BEHAVIOR OF TURBINE PUMPS OF HIGH POWER OR HIGH SPECIFIC SPEED DURING START-UP,
D. Florjancic, and D. Hartland.
Ver Deut Ing Ber Nr 75, p 27-36, 1964. Transl from Ger, Bur Reclam Transl 813, June 1969. 29 p, 20 fig.

Descriptors: *Pump turbines, *Hydraulic machinery, Pumps, Model tests, Hydraulic turbines, Compressed air, Turbine parts, Turbine runners, Model studies, Guide vanes, Investigations, Design, Foreign research, *Specific speed, Behavior.
Identifiers: Germany, Foreign testing, *Starting, Reversible turbines.

A survey of problems occurring during startup of reversible turbine pumps is given and procedures for limiting power input to the pump motor are described. Cause and magnitude of heavy alternating loads on guide vanes are described with reference to startup, emergency situations, and abnormal operating conditions. If water is depressed in a pump to reduce power consumption during startup, the greatest problems in power control occur as the pump is being rewatered. If adequate steps are not taken to control the movement of the increasing quantity of water in the pump, extremely rapid rise in power consumption can occur. The flow of water within a filling pump can be controlled by: (1) baffles designed to break up circular movements, (2) gates positioned between the suction tube and runner to prevent axial exchange-flow, (3) variation of the density of the medium by aerating, or (4) installation of turbulence jets to produce favorable flow characteristics in the suction tube. Measures to handle cases involving flow interruption during pumping or the transition from pump to turbine operation were considered. Results of model tests, suggestions for relieving startup problems, and the history of pump turbine technology are given. (USBR)
W69-09519

WASHING INSULATORS ON 500-KV LINES IS FOUND MOST EFFECTIVE,
Pacific Gas and Electric Co., San Francisco, Calif.
W. H. Zalabak.
Transm Distrib, Vol 21, No 5, pp 150-152, May 1969. 2 p, 4 fig.

Descriptors: *Power operation and maintenance, *Electrical insulators, *Contamination, Atmospheric pollution, *Transmission lines, Costs, Extra high voltage, Maintenance, Economies, High pressure, Safety.
Identifiers: *Live line maintenance, Contaminants, *Washing.

Experiences with transmission on the Pacific Gas and Electric Co system in California, indicated that the new 500-kv lines would require removal of insulator contamination, particularly true of installations in coastal areas where equipment is exposed to airborne salt and industrial contamination. Past experiences proved that energized line washing is the most economical method of removing contamination. Studies were made on the 500-kv lines in the Moss Landing area to determine whether washing or applying silicon grease would prove more economical. The study showed that over $200 per yr per tower could be saved by hotwashing. Rules covering the more critical points and several common sense rules were established for the safety of personnel when washing energized lines.
W69-09529

EFFECT OF SPECIFIC SPEED ON CENTRIFUGAL PUMP OPERATING CHARACTERISTICS,
Worthington Corp., Harrison, N.J.
Raymond A. Kugelman.
Water Wastes Eng, Vol 6, No 3, p B-24-B-27, Mar 1969. 4 p, 9 fig.

Descriptors: *Centrifugal pumps, *Pumps, Design, *Specific speed, Curves, Hydraulic machinery, Efficiencies, *Characteristics, Hydraulic design, Mixed flow pumps, Propeller pumps, Limiting factors, impellers, Pump testing.

Operating limitations of centrifugal pumps are occasionally dictated by the mechanical design. The prime reason for these limitations lies in the influence of the specific speed of the pump on operating conditions. The term specific speed does not refer to speed, but is an index number that classifies each pump. Specific speed establishes: (1) the shapes of the head-capacity, power-capacity, and efficiency-capacity curves; (2) the maximum efficiency that the pump will attain; and (3) the configuration of the impeller and all hydraulic passages. These characteristics determine the operating capabilities of the pump. Effects of specific speed on pump operating characteristics are discussed. (USBR)
W69-09538

HYDROELECTRIC GENERATING PLANTS AND PROJECTS.
For primary bibliographic entry see Field 06E.
W69-09637

PROBLEMS OF LARGE WATERWHEEL GENERATORS,
Westinghouse Electric Corp., East Pittsburgh, Pa.
E. C. Whitney.
Pap, Amer Power Conf, Chicago, Ill, Apr 1969. 4 p.

Descriptors: *Electric generators, *Hydroelectric power, Design, *Electrical design, Stators, Rotors, Thrust bearings, Thermal expansion, Magnetic fields, Manufacturing, Faults (Electrical), Electric relays, Temperature, Centrifugal forces, Erection, Maintenance, Handling equipment, Excitation, Voltage regulators, *Generators.
Identifiers: *Electric machinery, Air gaps, Protection (Electrical), Temperature rise.

Future problems likely to be encountered in designing and constructing large waterwheel generators are discussed, using as a guide the past experience gained from manufacturing machines rated 220,000 kva/261,000 hp, 225 rpm, 60 deg C rise, and designing 615,385-kva machines. On any large generator having a rotor diameter in excess of 50 ft, thermal expansion of the stator and rotor must be controlled so that the stator will remain concentric with the rotor, even though the time sequence of expansion of the stator is not the same as for the rotor. The magnetic pull in large machines may cause buckling of the stator punchings; when thermal expansion forces are combined with the magnetic pull, the problem is amplified. Stator sole plates must withstand frictional effects of thermal expansion and short circuit torques. Present methods used for differential and split phase protection must be improved. Mechanical problems, handling, excitation, and bearing design require special consideration when designing large waterwheel generators. (USBR)
W69-09765

8D. Soil Mechanics

BELLFIELD DAM, VICTORIA,
Victoria State Rivers and Water Supply Commission (Australia).
D. T. Currey, V. Michels, and D. J. Little.
Inst Eng, Aust. Civ Eng Trans, Vol CE 10, No 1, p 73-93, Apr 1968. 21 p, 17 fig, 1 tab, 18 ref, 2 append, disc.

Descriptors: *Earth dams, Embankments, Rockdill dams, Cutoffs, Foreign construction, Grout curtains, Dam foundations, Engineering geology, Rock excavation, Spillways, Outlet works, *Foundation investigations, Zoned embankments, Stability analysis, Construction, Earth handling equipment, Tunneling, Instrumentation, Bibliographies.
Identifiers: *Construction methods, Construction practices, Australia, *Bellfield Dam, Victoria (Australia).

The 180-ft Bellfield Dam, located 156 mile west-northwest of Melbourne, Australia, has a central earth core flanked by transition zones and supported by rockfill shoulders. The foundation investigation included diamond and percussion drilling, shafts, trenches, and seismic surveys. The foundation was sealed by a cutoff trench and a grout curtain. A volumetric balance between spillway excavation and embankment rockfill was maintained during design. A modified Swedish slip-circle method, applying May's graphical technique, was used for embankment stability analyses. The design and construction of the spillway and outlet works are described. A mixture of day-labor employees using Commission-owned equipment and contract methods was used during construction. Some 70 separate contracts and equipment-hire agreements were used, accounting for 50% of the total prime cost expenditure. Day-labor employees were used for high-labor-content activities. Close integration of specialist contracting groups with the Commission's experienced day-labor forces was primarily responsible for successful completion of the dam in a reasonable time and for a reasonable cost. (USBR)
W69-09521

REPLACEMENT OF WATER BY AIR IN SOIL PORES,
National Research Council of Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 02G.
W69-09525

MODEL STUDIES OF AN ARMOURED ROCKFILL OVERFLOW DAM,
International Engineering Co., Inc. San Francisco, Calif.
For primary bibliographic entry see Field 08B.
W69-09531

EARTH PRESSURES ON OTTAWA-OUTFALL SEWER TUNNEL,
National Research Council of Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 08A.
W69-09536

THE PROBLEM IN PREDICTING THE SUITABILITY OF SOILS FOR CEMENTITIOUS STABILIZATION,
Kent State Univ., Ohio.
J. B. Croft.
Eng Geol Int J, Vol 2, No 6, p 397-424, Nov 1968. 28 p, 17 fig, 2 tab, 27 ref.

Descriptors: Soils, *Soil stabilization, Soil types, Soil cement, Soil chemical properties, *Soil classifications, *Soil physical properties, Soil groups, Soil texture, Compressivestrength, Mineralogy, Soil tests, Clay minerals, Clays, Bibliographies, Soil mechanics.
Identifiers: Mineral content.

The suitability of a soil for stabilization, the most appropriate stabilizing agent, and the quantity of agent are determined by the chemical and mineralogical compositions and texture of a soil. Soil classification (based upon physical properties), compositional indices, and genetic relationships are examined to determine their value for predicting successful stabilization. Suitability of a soil depends upon criteria used to define successful stabilization. Specifications often require a

minimum unconfined compressive strength when there is little relation between this strength and the performance of the stabilized soil. Smaller quantities of stabilizing agent are required for modifying physical properties than for achieving the specified strength. Chemical and physical properties do not characterize soils uniquely with regard to their response to cementitious stabilizing agents. Grouping soils in an area according to their origins is a practical solution. (USBR)
W69-09540

8E. Rock Mechanics and Geology

TRANSIENT PRESSURE TESTING OF FRACTURED WATER INJECTION WELLS,
Pan American Petroleum Corp., Tulsa, Okla.
For primary bibliographic entry see Field 02F.
W69-09499

TRANSIENT STRESSES AND DISPLACEMENT AROUND A WELLBORE DUE TO FLUID FLOW IN TRANSVERSELY ISOTROPIC, POROUS MEDIA: 1. INFINITE RESERVOIRS,
Texas Univ., Austin.
For primary bibliographic entry see Field 02F.
W69-09503

STRESSES AROUND WELLBORES IN NONLINEAR ROCK,
California Univ., Berkeley.
M. A. Mahtab, and R. E. Goodman.
Trans Soc Petrol Eng, Amer Inst Mining, Met, and Petrol Eng, Inc, Vol 243, Part 2, p 304-312, 1968. 9 p, 21 fig, 4 tab, 6 ref.

Descriptors: *Boreholes, *Stress, *Stress analysis, Rocks, *Rock mechanics, Strain, Load distribution, Elasticity (Mechanical), Elastic deformation, Sandstones, Wells, Compressive strength, Boundaries (Property), Poisson ratio.
Identifiers: Borehole stresses in nonlinear rocks.

The state of stress around a vertical borehole in rock following nonlinear stress-strain laws is examined by means of a finite element analysis. The effects of nonlinearity of stresses are recorded for 6000-ft boreholes in schistose gneiss and Berea sandstone using results of laboratory triaxial compression tests. The effect is restricted to one well radius from the bottom periphery of the hole. Beyond a distance of one-quarter radius, the effect of nonlinearity on stresses is almost always less than 5% for the phases under investigation. The consideration of a static pressure inside the well does not change the effect of nonlinearity on borehole stresses. (Gabriel-USGS)
W69-09505

QUANTIFICATION IN CLAY MINERAL STUDIES OF SEDIMENTS AND SEDIMENTARY ROCKS,
Smithsonian Institution, Washington, D.C.,; and George Washington Univ., Washington, D.C.
J. W. Pierce, and F. R. Siegel.
J Sediment Petrology, Vol 39, No 1, p 187-193, Mar 1969. 7 p, 2 fig, 2 tab, 15 ref.

Descriptors: *Clay minerals, *Clays, Montmorillonite, Illite, Geology, Kaolinite, Statistical analysis, Quantitative analysis, *X-ray analysis, Calculations, Samples, Preparation, Treatment, Diffraction, Methodology, Mineralogy, Minerals, Geologic investigations, Bibliographies, *X-ray diffraction.
Identifiers: Diffractometers.

Percentages of clay minerals present in 25 complex samples were calculated by 5 different methods using the same X-ray diffractograms. Significantly different results were obtained by the various methods. Diffuiculties in clay mineral studies exist because of inherent factors in the clay minerals and variations in sample treatment and preparation methods. No preference is given to any one calculation technique because each is as well founded as any other. Preparation methods do not appear sufficiently well developed to produce accurate results. Standard samples containing well-crystallized minerals may cause preferential enrichment of certain minerals not generally found in natural mixtures. A unified methodology should be adopted so that semiquantitative clay mineral analyses may be used for comparisons. Until methodological standardization is achieved, reported analyses should include peak area measurements so that comparisons can be made after suitable recalculations. Without standardized sample treatment, preparation, and calculation methods, regional studies will remain incomparable and objectivity in the quantitative approach to geology may be hindered.
W69-09764

8F. Concrete

EXPERIENCE IN DESIGNING THE PRECAST REINFORCED CONCRETE BUILDING FOR THE SARATOV HYDROELECTRIC POWERPLANT,
A. K. Vakhrameev, V. N. Rudakov, and L. V. Baikova.
Gidrotekh Stroit, No 4, p 10-14, 1966. Transl from Russ, Bur Reclam Transl 704, June 1969. 21 p, 9 fig, 1 tab.

Descriptors: Foreign projects, *Precast concrete, Reinforced concrete, *Concrete technology, Hydraulic structures, Concrete structures, Costs, Hoisting machinery, Manufacturing, Erection, Joints, Foreign design practices, Cost comparisons, Draft tubes, Continuous structures, Joint fillers, Formwork (Construction), Welding, Reinforcement.
Identifiers: USSR, Saratov powerplant, USSR, Construction methods, Reinforcement cages.

The design and construction experience gained by Soviet builders at Saratov Hydroelectric Powerplant is summarized. The large-size precast reinforced-concrete elements used in erecting the underwater parts of the unique structure are feasible and competitive in cost. The main problem in constructing continuous, well-bonded joints to make the structure monolithic, watertight, and equal in strength to monolithic concrete has been solved. Large curvilinear parts can be manufactured satisfactorily in large-size elements on a conveyor line. Metal reinforcement cages for constructing elements without permanent forms had to meet the requirements of manufacturing, 3-dimensional rigidity, symmetrical placement of electrogrids for internal electroheating without too close proximity to reinforcement rods, and free clearance for lowering groups of 12 vibrators between rods and grids to compact the concrete mix. Several changes were made for keeping pier and floorbeam elements in place so that the concrete mix could be placed in the joint area and compacted by vibrators. Care in manufacturing the components resulted in easier and more economical erection. (USBR)
W69-09516

HOT-THERMOS METHOD OF CONCRETING,
Ia Besser.
Stroit, No 10, p 11-12, 1968. Transl from Russ, Bur Reclam Transl 533, Mar 1969. 6 p, 2 fig, 1 ref.

Descriptors: *Concrete technology, *Cold weather construction, Methodology, Concrete placing, Curing, *Heat treatment, Freezing, Heaters, Foreign construction, Calcium chloride, *Concrete construction, Concrete additives, Concrete mixes, Construction.
Identifiers: USSR, *Thermos method, Cold climates, Electroheating, Concrete properties.

The distinguishing part of the hot-thermos method of concreting is that the concrete mix, prepared from cold ingredients, is delivered to the concreting site and heated just before placement. Electroheating is accomplished in a 0.9-cu m tilting bin. Heating the mix to 70 deg C requires 10 to 15 min at 380 v and 120 to 150 kw. A 121-v source can be used when 1 to 1.5% sodium chloride is added, lowering the unit electrical resistance of the mix by about 2 to 3 times, and requiring 25 to 50 kw of power to heat the mix to 50 deg C in 20 min. A cycle including connecting and disconnecting electrical leads requires approximately 45 min. Using staggered operation of 2 bins and a 1.6-cu m dump truck, about 15 cu m of concrete can be produced per shift. If a grade of portland cement that produces concrete with a minimum compressive strength of 400 kg/sq cm is used, the mix attains 50% of design strength by the time it has cooled to zero deg C. The hot-thermos method reduced the cost per cu m of monolithic concrete by 3.5 to 5.5 rubles ($3.88-$6.10) over the cost of electroheating by the rod-electrode method. (USBR)
W69-09517

THERMAL TREATMENT OF HUGE PRECAST COMPONENTS FOR SARATOV HYDROELECTRIC POWERPLANT STRUCTURES,
N. V. Iudina.
Gidrotekh Stroit No 4, p 14-21, 1966. Transl from Russ, Bur Reclam Transl 705, Apr 1969. 28 p, 8 fig, 1 tab, 5 ref, 1 photo.

Descriptors: *Precast concrete, Reinforced concrete, *Concrete technology, Concrete structures, Strain, Foreign design practices, Freeze-thaw tests, Thermal stress, Concrete testing, *Electrodes, Heat flow, *Heat treatment, Cracking, *Cooling, Elasticity modulus, Creep, Quality control, Cold weather construction.
Identifiers: USSR, Foreign testing, Sratov powerplant, USSR, Precast concrete forms, *Electroheating, Temperature rise, Concrete properties.

Prior to inaugurating the assembly-line method of constructing huge precast reinforced-concrete components for Saratov Powerplant structures, field and theoretical investigations were made to determine the best method of heat-curing the 60- to 80-cu m components rapidly enough to permit unmolding at 10 to 12% design strength and erection at 60% without reducing quality or slowing flow of finished products to the erection site. Full-size specimens were tested by uniform periphery heating to 50 and 80 deg C and electrode-grid internal heating to 80 deg C. Internal electroheating, using the conductivity of the mix to raise the temperature of the specimen at the required rate, prevented surface cracking. Timing and temperatures of electroheating, cooling and moisture-curing cycles must be rigidly controlled to allow the concrete to attain full strength and frost resistance. Properties of the concrete in the specimens, variously treated and cured, were determined by testing cores drilled at different ages. Procedures for manufacturing massive components in summer and winter, the method of installing the electrode grids, and the tests leading to the recommendations are described. (USBR)
W69-09518

PRESTRESSED CONCRETE PILES,
Pomeroy (J. H.) and Co., Inc., San Francisco, Calif.; and Gerwick (Ben C.) Co., San Francisco, Calif.
Ben C. Gerwick, Jr.
J Prestressed Concr Inst, Vol 13, No 5, pp 66-93, Oct 1968. 28 p, 8 fig, 44 ref.

Descriptors: *Prestressed concrete, Pile bearing capacities, *Concrete piles, Bibliographies, Pile driving, *Pile foundations, Bending moments, Pile friction, Pile lateral loads, *Piles (Foundations), Friction piles, Sheet piling, Durability, Bearing piles, Cracking, Design, Ultimate loads, Foundations.
Identifiers: Splicing, Ultimate strength, Lightweight concretes, Pile caps, Pretensioning.

Prestressed concrete piles are employed extensively in marine structures and foundations. Advantages are strength in bearing and bending, durability, and economy. This report is a discussion of a state-of-the-art presentation on prestressed piling as used throughout the world. The field is discussed under the following headings: utilization, design, manufacture, installation, economy, sheet piling, fender piles, splices, problems and failures, durability, and research and development. The annual consumption of prestressed concrete piling is approximately 187 million ft. Prestressed concrete piles have been constructed in the cylindrical form up to 13.1 ft in diameter (Oosterschelde Bridge, Netherlands) and up to 230 ft long (offshore platforms in the Gulf of Maracaibo, Venezuela). In some parts of the U S, there is a trend toward using single long lengths without splices. Piles 131 ft long have been installed for major buildings in San Francisco and Boston. In other areas of the U. S. and other countries, the trend is toward the manufacture of standardized segments, spliced during driving. (USBR)
W69-09542

8G. Materials

FRICTION WEAR AND LUBRICATION,
Cambridge Univ. (England).
Michael J. Furey.
Ind Eng Chem, Vol 61, No 3, p 12-29, Mar 1969. 18 p, 12 fig, 2 tab, 67 ref.

Descriptors: *Friction, *Lubrication, Additives, Technology, Theory, Viscosity, Temperature, Pressure, Bibliographies, Foreign research, Physics, Roughness, Lubricants, Heat, Oil, Greases, Maintenance, Operation and maintenance, Power operation and maintenance.
Identifiers: Friction coefficient (Mech), *Wear, Great Britain, Roughness projections.

The study of friction, wear, and lubrication is approached as an important part of the broader subject of the solid-solid interface. Some special problems in studying solid-solid contact under static and dynamic conditions, and the theoretical and experimental approaches used are discussed. Not enough is known about the detailed conditions existing between rubbing solid surfaces, such as frequency of contact, surface temperatures, pressures, and shear rates. Examples of direct and indirect attempts to measure these conditions include a variety of studies in a high-contact stress, sliding system--a fixed ball on a rotating cylinder. Contact devices and radiotracer techniques have provided additional information on the function of antiwear and antifriction additives in boundary lubrication. Measurements of surface temperatures, using the dynamic thermocouple method, are described. Emphasis has been placed on the more fundamental aspects of solid-solid contact and on recent work in the field of boundary lubrication, the area in which physics and chemistry play important parts. (USBR)
W69-09520

8I. Fisheries Engineering

FISH AND GAME CONSERVATION.
For primary bibliographic entry see Field 06E.
W69-09641

FISH AND GAME CONSERVATION.
For primary bibliographic entry see Field 06E.
W69-09642

IMPORTING FISH.
For primary bibliographic entry see Field 06E.
W69-09643

CONTROL OF TEMPERATURES OF WATER DISCHARGED FROM A MULTIPLE-PURPOSE RESERVOIR,
Corps of Engineers, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
W69-09706

OPERATIONAL PROBLEMS ASSOCIATED WITH A BASIN RESERVOIR SYSTEM,
Corps of Engineers, Omaha, Nebr. Missouri River Div.
For primary bibliographic entry see Field 04A.
W69-09707

GAME AND FISH COMMISSION.
For primary bibliographic entry see Field 06E.
W69-09775

FISHING AND HUNTING LICENSES.
For primary bibliographic entry see Field 06E.
W69-09776

FISHING REGULATIONS.
For primary bibliographic entry see Field 06E.
W69-09785

MISCELLANEOUS PROVISIONS RELATING TO HUNTING AND FISHING.
For primary bibliographic entry see Field 06E.
W69-09786

MUSSELS.
For primary bibliographic entry see Field 06E.
W69-09787

COASTAL FISHERIES LAWS (FISH AND GAME).
For primary bibliographic entry see Field 06E.
W69-09814

FISH PROTECTIVE REGULATIONS.
For primary bibliographic entry see Field 06E.
W69-09815

FISH AND GAME CONSERVATION.
For primary bibliographic entry see Field 06E.
W69-09841

COMMERCIAL FISHING.
For primary bibliographic entry see Field 06E.
W69-09842

10. SCIENTIFIC AND TECHNICAL INFORMATION

THE IDENTIFICATION AND CRITICAL ANALYSIS OF SELECTED LITERATURE DEALING WITH THE RECREATIONAL ASPECTS OF WATER RESOURCES USE, PLANNING, AND DEVELOPMENT,
Illinois Univ., Urbana. Water Resources Center.
Robert B. Ditton.
Research Report No 23, Water Resources Center, University of Illinois, June 1969. 293 p, 3 tab, 809 ref. OWRR Project A-025-ILL.

Descriptors: *Recreation, Recreation demand, Water quality, Attitudes, Behavior, *Planning, Hydrology, Legal aspects, Water quality control, Water pollution effects, Research and development, Reviews, Bibliographies, Documentation, *Information retrieval.

This study integrates and summarizes the highly, fragmented, interdisciplinary body of knowledge dealing with recreation and water. Over one thousand publications were identified, documented, and classified according to keywork descriptors. A topical computerized bibliographic retrieval routine was developed. Using this retrieval system, the project surveyed and critically analyzed research findings and their implications for water recreation planning and development. The narrative critical analysis of pertinent literature is organized within five broad areas: (1) the water resource, (2) water resource recreation planning, (3) user-resource planning considerations, (4) factors inhibiting the recreational use of water resources, and (5) maintaining water quality for recreational use. In citing gaps in existing methods and knowledge, this critical analysis forms the bibliographic foundation for a programatic identification of interdisciplinary recreation-water resources research needs. These research needs are grouped according to: (1) the water resource, (2) user-resource planning, (3) water quality maintenance for recreational use. An extensive bibliography is included. (Betchart-Univ of Ill)
W69-09719

A PLAN FOR A COMPREHENSIVE WATER RESOURCES RESEARCH INFORMATION EXCHANGE SYSTEM,
Leeds, Hill and Jewett, Inc., San Francisco, Calif.
Harvey O. Banks, and Charles G. Wolfe.
Available from the Clearinghouse as PB-185 801 for $3.00 in paper copy, $0.65 in microfiche. Final Report to OWRR, Jul 1969. 137 p.

Descriptors: *Documentation, *Reviews, *Planning, Publication, Information retrieval.
Identifiers: State Water Resources Research Institutes, Information exchange, Technical societies.

A study was made of the nature and effectiveness of the present procedures used by the Office of Water Resources Research of the United States Department of the Interior and the 51 State Water Resources Research Institutes to obtain information on problems requiring research and to disseminate the results of research projects. A survey conducted among heads of water development and water quality control agencies in every state, officials of water departments or utilities in major American cities, and selected consulting engineering firms throughout the country specializing in water matters revealed that the research information exchange systems of OWRR and the State Institutes have not been effective. Only 49% of these potential users were able to name a water research project sponsored by OWRR in their home state, only 21% were able to name an OWRR sponsored project in some other state, and only 14% were able to name an OWRR research project, the result of which they had used in their work. More than half, 53%, of the potential users felt that there were problems which required study, which were not being investigated. The report contains a recommended research information exchange system to overcome the demonstrated deficiencies of the existing systems. In the recommended system, the information gathering and dissemination activities of OWRR and the State Institutes would be better defined and would be expanded, and use would be made of the capabilities of Federal information dissemination services, Professional Societies, and other communication media.
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